83
S-Y 64.5

HARVARD UNIVERSITY

LIBRARY

OF THE

Museum of Comparative Zoology

LIBRARY
MUS. COMP. ZOOLOGY
CAMBRIDGE, MASS.

LIBRARY
MUS. COMP. ZOOLOGY
CAMBRIDGE, MASS.

THE TRANSACTIONS OF THE YORKSHIRE NATURALISTS' UNION.
PART 12,
ISSUED TO MEMBERS FOR THE YEAR 1886.

3735

Museum of Comparative Zoology
OCT 11 1945
LIBRARY

(SECOND EDITION OF)

NORTH YORKSHIRE:

STUDIES OF ITS BOTANY, GEOLOGY, CLIMATE, AND PHYSICAL GEOGRAPHY.

BY

JOHN GILBERT BAKER, F.R.S., F.L.S.,

OF THE ROYAL HERBARIUM, KEW, EX-PRESIDENT AND PERMANENT VICE-PRESIDENT OF THE YORKSHIRE NATURALISTS' UNION.

CONTENTS

OF SECOND INSTALMENT (6 SHEETS AND 2 MAPS).

LITHOLOGY (With Coloured Map) ... ... pp. 49— 72.
CLIMATOLOGY (With Coloured Map) ... ... pp. 73—120.
TOPOGRAPHY and PHYSICAL GEOGRAPHY ... pp. 121—127.
DESCRIPTION OF WEST TEES DISTRICT ... ... pp. 128—144.

The next instalment will include the description of the Drainage Districts, and probably the commencement of the Flora proper].

LEEDS:
PRINTED FOR THE YORKSHIRE NATURALISTS' UNION
BY TAYLOR BROTHERS.

JANUARY, 1889.

NORTH RIDING OF YORKSHIRE.
LITHOLOGICAL MAP.
English Miles
0 2 4 6 8 10 12
EXPLANATION.
1.—Pure DYSGEOGENOUS Strata — Bright ORANGE.
(Tracts underlaid with hard non-absorbent rock.)
2.—SUB-DYSGEOGENOUS Strata — Pale YELLOW.
(Tracts underlaid with bands of hard non-absorbent rock, with softer or more porous beds interpolated between them.)
3.—EUGEOGENOUS Strata . GREY.
(Tracts underlaid with softer and more porous strata.)

Museum of Comparative Zoology
OCT 11 1945
LIBRARY

80424

LITHOLOGY.

Dysgeogenous and Eugeogenous Strata.—As may be gathered from what has been stated in the chapter devoted to Geology, the rocks of the different periods in North Yorkshire are, for each as a whole, characterised by well-marked lithological peculiarities; and from this circumstance arises the fact that the tracts which they respectively underlie are found to possess tangibly marked physico-geographical peculiarities. To the question of the differences in mechanical constitution which the various strata present and the results which may be traced as springing from such differences as their primary cause it will therefore be needful to devote a few pages before proceeding further.

Two principal types of rock in respect of mechanical constitution may be traced. Following the nomenclature of the elaborate treatise upon this subject of M. Thurmann * I propose to call them *Eugeogenous* (plentiful-detritus-bearing) and *Dysgeogenous* (sparing-detritus-yielding), these terms being better calculated than any which have been previously employed which I can call to mind to keep prominently in view what is essential to be remembered.

The essential differences between the rocks of the two kinds are mainly in respect of their hardness, their power of absorbing and retaining moisture in small masses, their permeability when we consider them as forming extensive strata, and the differences in their power of yielding detritus which result from these characteristics. If we arrange the different kinds of rock in a scale according to their hardness and permeability, beginning with those which possess the smallest capacity for absorption

* Essai de Phytostatique applique à la chaine du Jura par Jules Thurmann, Berne 1849, London, Williams and Norgate. See also a pamphlet of my own entitled "An attempt to classify the Flowering Plants and Ferns of Britain according to their Geognostic relations," published in 1855.

and offer the greatest resistance to abrading influences, we shall have to place in the first rank the compact Limestones, Granites and Basalts; after them the compact Slaty rocks and Limestones like the Coralline Oolite and Calcareous Gritstone; then must follow some of the metamorphosed igneous rocks and the harder kinds of compact sandstone like the Brimham Grit and Kelloways band; then many of the Freestones, Flagstones and Chalks; and last of all and most absorbent of all are most of the rocks in which the argillaceous element is predominant, the Plates and Clays of the Carboniferous beds, the Shales and Clays of the Trias and the Lias, the Oxford Clays and Kimmeridge Clays of the Oolite. As regards permeability when bedded in extensive strata it is almost always the Limestones which are the most conspicuously traversed by fissures and breaks, and the softer argillaceous rocks which are the most compact, the sandstones and harder siliceo-aluminous beds occupying an intermediate position. The power which the different kinds of rock have of yielding detritus depends upon their position in the scale which has been indicated, and, especially when they form hill-masses and are permeable upon a grand scale, the soils which cover the dysgeogenous rocks are comparatively dry, whilst those which cover the eugeogenous rocks are comparatively humid.

We see that difference in respect of the characteristics which have just been noticed does not by any means run precisely parallel with difference in chemical composition. Calcareous rocks are not always dysgeogenous nor arenaceous and argillaceous rocks always eugeogenous, though such is most frequently the case. We must put the Limestones of the Carboniferous, Permian and Oolitic periods upon one side and place Basalt along with them; and on the other side Clays like those of the Lias and Triassic System, and Sandstones like those of the Trias, the Millstone Grit and the Lower Oolite, Chalk with the Slates and most of the Granitic rocks occupying an intermediate position. And a characteristic feature of our field of study and that which constitutes its special interest from the point of view

which we are now occupying is that in it the strata of the different periods not only underlie well-defined districts, but that they are composed either of rocks of well-marked eugeogenous type or of well-marked dysgeogenous type, or of bands of the two kinds mixed up together in the deposits of one period: and that, as we have already seen, rocks of intermediate lithological constitution, as occupying large tracts of surface, are entirely absent.

Their Distribution throughout North Yorkshire.—The following table, then, is a repetition, except that the thickness of the beds is omitted, of that which was given at the end of the chapter on Geology, each series being referred to its proper lithological type.

LITHOLOGICAL CLASSIFICATION OF THE YORKSHIRE STRATA.

GEOLOGY.	Approximate area in square miles.	Lithological character.
Mountain Limestone and Basalt	330	Subdysgeogenous
Millstone Grit	330	Eugeogenous
Magnesian Limestone	10	Dysgeogenous
Trias	500	Eugeogenous
Lias and Lower Oolite	660	Eugeogenous
Middle Oolite	200	Dysgeogenous
Upper Oolite	80	Eugeogenous

So that we have on the west bands of hard dry rock with thick eugeogenous interpolations between them forming the edges of most of the dales and ascending in some places to the loftier mountain summits, but more usually these summits and the higher surfaces of the moorlands, like their slope in the direction of the central valley, are formed of eugeogenous materials. Next follows a narrow strip of dysgeogenous and a broad area of eugeogenous lowland country, and on the east are two extensive tracts of moorland with contrasting lithological characters, both of which rise into the Middle Zone, and last of all we have on the south of them a eugeogenous valley, the proportion of eugeogenous surface to that of dysgeogenous being for North Yorkshire as a whole fully three to one.

Their Influence upon the Configuration of the Dales and Hill-masses.—The results of these lithological differences are to be found, not only in the modification which they produce upon the general contour of the surface and the influence which they exercise in determining the shape of the dales and the configuration of the hill-masses, but they exercise also an influence which is by no means unimportant upon the topography of the vegetation. We will take the first question first and examine their influence upon a large scale and then treat the matter in its botanico-geographical bearings.

The different beds and bands of rock have all since the period of their original deposition been subjected to the influence of energetic watery action. The glacial inundation must have reached a height of at least 1000 feet above the present sea-level, and that is only one flood amongst many. In almost all the dales the strata upon the opposite sides of the dale correspond to each other precisely. This correspondence is disturbed by faults in Teesdale, Lunedale and Arkengarthdale, and by smaller dislocations elsewhere, but as a rule our dales are dales of denudation. In Wensleydale we have the same bands of limestone in the fells upon both sides of the hollow with an excavation between them which often reaches a mile in width and a thousand feet in depth. In the dales of the Esk and Derwent districts the sandstones of the Lower Oolite may usually be seen above the shales of the Upper Lias upon both sides at an equal elevation above the stream. And we find that the general contour of the surface and configuration of the dales and coast is very much to be explained by the fact that the strata of different degrees of hardness have been unequally worn away.

Both upon the east and in the west in the hill country two different types of scenery may be traced. The flat table lands of the limestone hills contrast conspicuously with the irregular undulations of the sandstone hills: the steep precipitous calcareous scars not less so with the irregular 'edges' of freestone

and gritstone. The sandstone hills are usually intersected by branching rivulets which flow from their upper levels gradually down their slopes into the low country: the limestone hills have neither streams nor natural pools upon their surfaces, but the glens slope suddenly and the water sinks through the calcareous beds to gush out in large volume when it reaches some less permeable stratum. The sandstone dales are open and irregular with gradual slopes and undulated embankments: the limestone dales are steep and narrow with sudden slopes and embankments rising up like a wall upon each side to shut them in.

It is in the east that the characteristic features of the hills of the two types are seen most readily. We have there two ranges of hills, one of which is fully 400 and the other 200 square miles in area, which throughout their extent are composed, the northern range of well-marked eugeogenous and the southern mass of well-marked dysgeogenous materials: and most of the main branches of the Derwent rise amongst the sandstone hills and break through the limestone range before they enter into the low country. As they pass from one range to the other the change is so striking that it cannot fail to arrest the attention of the most casual observer. The difference in outline of the two kinds of hill may be well seen by looking up Bransdale or Farndale from the vale of Pickering. We have then immediately in front the flat plateaux and steep narrow dales of the calcareous range with its steep escarpment towards the north sweeping far away eastward and westward, and beyond rise the irregularly undulated masses of the heathery arenaceous moors with the high anticlinal ridge to bound the horizon. In the upper part of the dales the woods are scattered irregularly over their slopes and are more frequently to be found along the margins of the streams than anywhere else, but in their lower portion the steep calcareous embankments are usually covered thickly with wood from the edge of the plateau all the way down the slope and the stream-side at the bottom of the dale left free. The Bran and the Dove are both partly swallowed up

by the limestone, the former in Kirkdale, the latter near Kirby-moorside, and of springs where a large volume of water flows out from the limestone we have instances at the Keld heads near Pickering, where the Costa has its source, and in the springs of invariable temperature respecting which we shall speak in the chapter on Climate.

In the main dales of the west, especially in the upper parts of Swaledale and Wensleydale, it will be remembered that the hill slopes are composed of the Yoredale series of strata, and that this consists of six parallel bands of limestone with thick interpolations of eugeogenous rock. 'Where it exists complete,' writes Professor Phillips, 'as at the head of Wensleydale, the Yoredale series admits of being exactly characterised in a drawing, so that its parts may be again recognised in other situations. For example, take the profile of a mountain whose top is capped with Millstone Grit and whose base rests upon the Lower Scar Limestone, its whole slope being formed of Yoredale rocks 800 to 1000 feet thick and the series complete. The profile will present the following leading features. At the top of the series, under a round or angular top of Millstone Grit and perhaps a small edge of Chert or Little Limestone the Main or Twelve-fathom Limestone will project into a bold perpendicular scar: below it will be a little concave or flat slope terminated by a second and less conspicuous projection of the thinner Underset Limestone: a long slope succeeds, simple or slightly varied with rising undulations corresponding to the hard gritstones interstratified with shales: this ends above a single or double scar of the Middle Limestone, which is very conspicuous where thick, as in Addlebrough and Penhill, but easily lost by the detritus of the superior rocks where it is thin, as above Hawes: below this there is another slope to the Simonside Limestone, which forms a smooth terrace; another steep slope to the Hardraw Limestone, which runs for miles along both sides of Wensleydale in a remarkable terrace, occasionally wooded, always very abrupt and rocky at the edge, and based upon a

steep slope of plates leading to the broad floors of the Lower Scar Limestone.' In its general lithological characters the Millstone Grit much resembles the Lower Oolite and its peaks and ridges rise above the Main Limestone scars with usually the same rotundity and undulation of slope and the same comparative humidity of surface which have just been mentioned as characteristic of the northern range of moorlands situated on the east of the Central Valley.

There is in 'Rokeby' the description of a glen of each kind: the gill where the Greta below Mortham flows beneath scars of Main Limestone to pour its waters into the Tees; and the neighbouring hollow of Thorsgill with its gradual arenaceous slopes. Here we have not only the physico-geographical facts, but also the ideas and imaginations thereby suggested.

THE GLEN OF THE GRETA.

'By Barnard's bridge of stately stone
The southern bank of Tees they won,
Their winding path then eastward cast,
And Eglestone's grey ruins past;
And skirting high the valley's ridge
They crossed by Greta's ancient bridge,
Descending where her waters wind,
Free for a space and unconfined,
As 'scaped from Brignall's dark wood glen
She seeks wild Mortham's deeper den.

* * * *

The open vale is soon passed o'er,
Rokeby though nigh is seen no more;
Sinking 'mid Greta's thickets deep,
A wild and darker course they keep;
Broad shadows o'er their passage fell,
Deeper and narrower grew the dell,
It seemed some mountain rent and riven,
A channel for the stream had given,
So high the cliffs of limestone grey
Hung beetling o'er the torrent's way,
Yielding along their rugged base
A flinty footpath's niggard space,
Where he who winds 'twixt rock and wave
May hear the headlong torrent rave,
And like a steed in frantic fit
That flings the froth from curb and bit,
May view her chafe her waves to spray
O'er every rock that bars her way.

* * *

THORSGILL.

'When Denmark's Raven soared on high
Triumphant through Northumbrian sky,
Till hovering near, her fatal croak
Bade Reged's Britons dread the yoke,
And the broad shadow of her wing
Blackened each cataract and spring
Where Tees in tumult leaves her source
Thundering o'er Caldron and High Force,
Beneath the shade the Northmen came,
Fixed on each vale a Runic name,
Reared high their altar's rugged stone,
And gave their gods the land they won.
Then Balder, one bleak garth was thine,
And one sweet brooklet's silver line,
And Woden's Croft did title gain
From the stern father of the slain,
But to the Monarch of the mace
That held in fight the foremost place,
To Odin's son and Sifia's spouse
Near Starforth high they paid their vows,
Remembered Thor's victorious fame,
And gave the dell the Thunderer's name.
Yet Scald or Kemper erred, I ween,
Who gave that soft and quiet scene,
With all its varied light and shade,
And every little sunny glade,
And the blithe brook that strolls along
Its pebbled bed with summer song,
To the grim god of blood and scar,
The grisly king of northern war.
Oh, better were its banks assigned
To spirits of a gentler kind!'

THE GLEN OF THE GRETA.

The cliffs that rear their haughty head
High o'er the river's darksome bed
Were now all naked wild and grey,
Now waving all with greenwood spray;
Here trees to every crevice clung
And o'er the dell their branches hung,
And there all splintered and uneven
The shivered rocks ascend to heaven;
Oft too the ivy swathed their breast
And wreathed its garland round their crest,
Or from the spires bade loosely flare
Its tendrils in the middle air,
As pennons wont to wave of old
O'er the high feast of Baron bold
When revelled loud the feudal rout
And the arched halls returned their shout;
Such and more wild is Greta's roar,
And such the echoes from her shore,
And so the ivied banners gleam
Waved wildly o'er the brawling stream.'

THORSGILL.

For where the thicket groups recede
And the rath primrose decks the mead,
The velvet grass seems carpet meet
For the light fairies' lively feet;
Yon tufted knoll with daisies strewn
Might make proud Oberon a throne,
While hidden in the thicket nigh
Puck should brood o'er his frolic sly,
And where profuse the wood-vetch clings
Round Ash and Elm in verdant rings
Its pale and azure-pencilled flower
Might canopy Titania's bower.
Here rise no cliffs the vale to shade,
But skirting every sunny glade,
In fair variety of green,
The woodland lends its sylvan scene,
And all beneath at random grow
Each coppice dwarf of varied show,
Or round the stems profusely twined
Fling summer odours on the wind.'

Their Influence upon the Topography of the Vegetation.—The rocks of the different kinds furnish to unite with vegetable humus to make the soils above them a detritus more or less abundant in proportion to their permeability, sometimes clayey, sometimes sandy, sometimes partaking of the two natures combined: and in the low country bands of boulder clay and sand and gravel, the contributions from all the different beds mixed up together, usually overspread the subjacent rock to a considerable depth. Upon the permeability on a grand scale of its subjacent strata and the proportion in which the different kinds of detritus enter into the composition of its subsoils the natural fertility of any particular tract of country and the sort of stations which it furnishes for wild plants to grow in, to a considerable extent depends. The difference between the different kinds of soil in their power of absorbing and retaining moisture is very great. If we take a quantity of dry sand and put it into a bag and pour water upon it, we shall find that it will not absorb more than a quarter of its own weight of the water: but vegetable loam will absorb 40 to 50 per cent of its own weight, and pure dry argillaceous clay as much as 60 or 70 per cent. A predominance of clayey detritus in a soil gives to it consistency, tenacity,

impermeability ; a predominance of sandy detritus powderyness, mobility and divisibility. Argillaceous soils are comparatively humid and cold and in dry weather become hardened and form a crust upon their surfaces. Arenaceous soils offer the opposite advantages and disadvantages ; they are often light and sterile and in dry weather soon become at their surfaces arid and parched.

In the chapter upon Climate we shall see how the ripening of the hay crop and harvest in the low country is in an ordinary season accelerated before the average on the light sandy soils, retarded behind the average on the humid clayey soils ; and how the difference between heavier soils and a somewhat more northern exposure and lighter soils and a more sheltered situation makes at equal altitudes between different parts of our field of study the difference between the Vine, the Fig, and the Spanish Chesnut yielding or not yielding eatable fruit. In Istria M. Tommasini appraises the superiority of the light soils underlaid by limestone over the heavy soils underlaid by argillaceous rock at two degrees of Reaumur's thermometer, even although the former are somewhat hilly and also more northern in position. We shall see also what is the difference in the yield of the Cereal crops between the argillaceous soils of Cleveland and the comparatively porous soils of the Central Valley, and with regard to wild plants we find that there is for them upon the well-marked argillaceous soils a comparatively restricted range of station, and that in tracts of country underlaid by rock of this character and overlaid by detritus in which the argillaceous element preponderates the wild plants which occur are mostly such as are widely distributed throughout Britain and ascend to high latitudes and altitudes ; whilst not unfrequently in sandy soils we have pascual and glareal species which are less abundant and less boreal in their distribution. Under equal climates and at equal elevations, we may say safely that an argillaceous soil has a more humid and a more boreal vegetation ; an arenaceous soil, unless overspread by heath, a

flora more varied and more southern. As determining differences between the floras of limited tracts the results of this difference may be traced, but throughout the various parts of our low country the different kinds of soil are so much mixed up together that as regards its application to the topography of our vegetation this is all the result that can fairly be attributed to it with clearness.

The most prominent contrasts concerning topography of vegetation of which we have to speak are in the first place the restriction of a category of specially Xerophilous or dry-loving species to the dysgeogenous soils in such a way that this restriction is one of the most prominent features of their role of distribution; and in the second place as regards the modification which the influence of the subjacent rock exercises upon the altitudinal range of certain species. Though to a certain extent it involves the repetition of what has been already dwelt upon, I will quote from my note-book, in order to connect together more clearly what follows with what has been stated already, two extracts which give an account of excursions made to hills of the two lithological types and which enumerate also the commoner or more conspicuous plants which the two hill-surfaces and their slopes produce.

'*The Harriet Air near Rievaulx, and Ouldray Gill.*—A plateau with the beds of limestone rock not far from the surface, covered with elastic wiry grassy turf, the constituent elements of which are the common plants of pastures, but scattered over with Carlina and Bee-orchis, and with Thyme and Rock-rose and *Poterium Sanguisorba* in knolls upon its undulations, and a few scraggy bushes of Hawthorn and a few blocks of hard massive calcareous gritstone scattered over its slope in the direction of the main dale.

The plateau is about 600 feet in elevation above the sea-level, and there are two or three farm-houses upon it, with Sycamore and Scotch Fir planted to shelter them from the moorland breezes, and there are fields of Oats and Rape and forage,

bounded some of them by hedges of Whitethorn and Blackthorn, and some of them by walls the art of building which must certainly require a special apprenticeship, for the blocks, which are this same compact calcareous gritstone, are of all kinds of sizes and of all kinds of shapes except absolutely round, and yet no cement or mortar is employed. The prominent mosses of the walls are *Leskea sericea* and *Tortula ruralis*, the prominent lichens *Parmelia calcarea* and *murorum*, *Collema nigrum*, *Biatora rupestris* and the pitted Lecideæ and Verrucariæ. Upon the plateau there are no natural streams or ponds, nothing but artificial specimens of the latter, glaringly artificial in their primness of contour, the work perhaps of the professional 'artificial pond-maker' whose sign is to be seen at Helmsley.

The main gill is approached in this direction down a narrow gradually-sloping gorge, dark with overshadowing woods, with mainly, now that the Primroses and Wood Anemones have gone, a thick undergrowth of the Geums and *Allium ursinum*, and with abundance of the tall succulent branching stems and lurid digitated leaves of *Helleborus viridis* and here and there bushes of *Actæa spicata* scattered amongst it, the sombre greenness pleasantly relieved by *Lychnis* and *Stellaria*, by patches of fresh bright blue which *Myosotis sylvatica* and the Hyacinth furnish, and the bright golden globes of a colony of *Trollius* which has established itself at the bottom of the wood.

The principal gill is one of a thoroughly calcareous stamp, such an one as these hills of the Middle Oolite abound in. The steeply sloping bank upon the north-west is not less than 300 or 400 feet in height and is covered thickly with aboriginal wood, the Oak the principal tree, but far more of Hazel than anything else, Ash, Hawthorn, Wych Elm, *Salix Caprea*, Elder, Maple, Honeysuckle, Roses and Brambles. The soil over the subjacent rock is thin and gravelly. There is a glorious undergrowth of *Rubus saxatilis* beneath the bushes, plenty to yield a large basketful of Rock Brambles at fruiting-time, and abundance of *Origanum vulgare* and wiry grass and sedge (*Brachypodium*

sylvaticum, *Bromus asper*, *Melica nutans*, *M. uniflora*, *Carex digitata*, *C. glauca*, *C. sylvatica*), and in lesser quantity *Aquilegia* and *Actæa*, *Viola hirta*, *Hypericum hirsutum* and *H. montanum*. Upon the opposite side of the gill the soil is damper and more loamy and *Lathræa* and *Neottia* may be found, upon the stones abundance of *Rhynchostegium murale*, and upon the lower edge of the wood *Polypodium Dryopteris* and Bilberry, *Blechnum boreale* and *Calluna*.

There is no stream till we reach the surface of the Oxford Clay, 400 feet below the top of the plateau, and then a bright clear little brook gushes out and soon gathers to a rivulet of tolerable size, fed by springs the outpouring of which trickles through oozy plashes rich with bright green and purple moss (notably *Hypnum condensatum* and also *Bryum ventricosum*, *H. cuspidatum*, *H. revolvens*, *Camptothecium nitens*, *Mnium affine* and *Bartramia calcarea*), and diversified by swamp Carices (*C. fulva*, *C. flava*, *C. dioica*, *C. pulicaris*, *C. stellulata*), *Eriophorum latifolium*, *Primula farinosa*, *Lychnis Flos-cuculi*, *Caltha*, and *Epipactis palustris*. In one place there is a swampy thicket filled with bushes of *Salix Andersoniana*. At the lower part of the gill there is a space of pasture-land on both sides of the stream, and some of the woods upon its slope consist of planted Coniferæ. It is altogether about three miles in length and opens out at the town of Helmsley.'

'*Rombald's Moor and the Cow and Calf Rocks over Ilkley.*—Between the two dales (Wharfedale and Airedale) there is a ridge of hill which is here some three or four miles across, which rises at the centre of the ridge to a height of 1300 feet, and over the edge of the dales is from 900 to 1000 above the sea-level, 600 to 700 feet above the main streams. Everywhere from the watershed to the dale edges sweeps a continuous surface of undulated turfy heatherland, over the sandstone a thinner or thicker covering of soft rich brown peat and everywhere that same so well-known gregarious heatherland vegetation. Far away it sweeps, miles to eastward along where the ridge grows lower

and narrower, and the dales open out, and the towns grow larger and busier and smokier, far away to westward where the dales grow narrower and steeper, and the ridges higher and the summits rise, hundreds and hundreds of square miles in area over the higher ground, one broad surface of treeless, houseless, uncultivated moor. Of the Ericaceous shrubs *Calluna vulgaris* is much the most abundant, and there are also *Erica cinerea* and *E. Tetralix*, *Empetrum nigrum* and *Vaccinium Myrtillus*, thick-swelling in the hollows and over the turfy undulations, stunted and rough where the ground is drier and the rock nearer the surface. In the drier places *Juncus squarrosus*, *Galium saxatile*, *Nardus stricta* and *Aira flexuosa* are the most prominent plants, and of the ferns *Blechnum boreale* and the Common Brake. Amongst the heather *Hylocomium splendens* is the commonest moss and of the Lichens *Cetraria aculeata* and *Cladonia rangiferina* and *C. coccifera* and in the spaces between the tufts are *Polytrichum commune* and *Dicranum scoparium.* In the swamps grow *Scirpus cæspitosus*, *Eriophorum vaginatum* and sometimes *Drosera rotundifolia* and *Narthecium*, and in pools and peaty rills abundance of *Hypnum fluitans*, *Leucobryum glaucum* and various species of *Sphagnum.* Where the turf has been bared away for fuel are *Polytrichum piliferum* and *P. juniperinum* and wide-spreading patches of *Ceratodon purpureus.* *Vaccinium Vitis-idæa* is not plentiful here, and *V. Oxycoccus* I know in this neighbourhood in one swamp only, where *Corydalis claviculata* grows upon the rock below.

The crest of the hill is marked by an irregular line of scar-like 'edges' of gritstone, huge boulders of which are piled about in picturesque confusion immediately beneath the edge and scattered more sparingly far down below towards the bottom of the slope; and the walls along the hill-side and over the moor-top are built of loosely-piled blocks of this same gritstone, which is a sandstone of coarse grain and moderate firmness of texture, with large crystals of quartz thickly imbedded amongst it. As in all the gritstones the blocks are rough and unshapely and

are much pitted and channelled by the influence of time and weather. There are numerous lichens upon the rocks and walls, *Endocarpon smaragdulum*, *Biatora polytropa*, thin-crusted black-fruited *Lecideæ*, *Parmelia saxatilis*, *P. physodes* and other foliaceous species, fringe-like tufts of *Evernia jubata* and *E. furfuracea*; and in the shaded sandy ground beneath the rocks and in the trenches by the wall-sides abundance of *Dicranella heteromalla* and *Jungermannia albicans*. The peaty rills gradually converge to the head of a little grassy gill, and the streamlet which they form, not as in the limestone sinking through the surface of the hill to appear as a full-grown rivulet at the foot of its slope, makes its way down the hill-side with much animation, at first forcing a road down a narrow channel where it is almost hidden by overhanging grasses and rushes, and gathering as it goes, fed by the numerous tiny watercourses edged by *Stellaria uliginosa* and *Montia fontana*, now leaping with foam and bubbles over a moss-fringed rock that would interpose to bar its progress and ever and anon spreading out into a more open channel and rippling noisily over the scattered pebbles. The principal mosses of the stream are *Racomitrium aciculare*, *Hyocomium flagellare* and a form of *Hypnum palustre*: and the swamps upon the hill-sides yield abundance of *Sphagna*, *Bartramia fontana*, *Bryum ventricosum*, *Aulacomnion palustre*, *Hypnum fluitans*, *H. cuspidatum*, and *H. stramineum*: and of the less frequent species the bogs yield *Hypnum exannulatum* and *Mnium subglobosum* and the walls and rocks *Dicranum fuscescens*, *Weissia cirrhata*, and *Ptychomitrium polyphyllum*. The natural woods of the hill-side are principally Oak, with more Rowan and Birch, and less Hazel and Ash than in the limestone dales, with more of swamp (with *Chrysosplenium*, *Caltha*, *Cardamine sylvatica*, *Crepis paludosa*, *Equisetum Telmateia*, *Spiræa Ulmaria*) and less of underwood and entirely without the characteristically Xerophilous species.'

Amongst the higher moorlands of the west there is a difference in vegetation which is conspicuously connected with the difference between the hills of the two types in respect of humidity of

surface. Into the Upper zone three of the limestone hills ascend, Mickle Fell, Cam Fell, and Widdale Fell: and within its limits the surfaces of these are covered in some places with a short grassy turf which yields several of the species which are common in grassy places throughout the low country, and in the crevices of the limestone rock a few ferns and shade-loving plants occur, and a few of the characteristically Montane species are also to be met with, as for instance *Draba incana*, *Viola lutea*, *Saxifraga hypnoides*, and *Arenaria verna*. To those portions of these three hills where the limestone rock is at or near the surface fully two-thirds of the Flowering Plants and Ferns which ascend into the Upper zone are restricted. Which these species are can be ascertained so readily by a glance through the list in the Botanical portion of these notes that it does not appear needful to recapitulate them here. But the far more numerous arenaceous peaks and ridges which ascend into the Upper zone present everywhere what a botanist on the outlook for rarities is apt to consider a monotonous repetition of the common gregarious plants of a swampy heatherland, so that the following florula, which is a list of all the species observed within the limits of the Upper zone upon Raven's Seat moor and Nine Standards might, with little variation, stand for any of the other hill-summits of the eugeogenous type.

FLORULA OF THE UPPER ZONE ON A EUGEOGENOUS HILL.

Drosera rotundifolia	Vaccinium Myrtillus	Eriophorum angustifolium
Cerastium triviale	Juncus effusus	Agrostis vulgaris
Rubus Chamæmorus	,, squarrosus	Aira flexuosa
Galium saxatile	Empetrum nigrum	Festuca ovina
Erica Tetralix	Scirpus cæspitosus	Nardus stricta.
Calluna vulgaris	Eriophorum vaginatum	

Throughout the moorlands both upon the east and west of the Central Valley this swamp-heatherland vegetation attains its greatest perfection and covers without intermission the widest tracts of surface over the Millstone Grit and the Lower Oolite:

whilst the dysgeogenous hills are more grassy and in the two upper zones it is far more usually amongst the scars of the limestone and the short grassy turf which the limestones immediately underlie that the ascending stations of the common pascual, pratal, mural and glareal plants of the low country are to be found. A glance at the botanical list will show how very frequently the 'Main Limestone' and the 'Hambleton plateau' are mentioned in connection with the ascending limits of species. And on the other hand, the heatherlands of the Central Valley are all based upon sandstone, and with them *Drosera anglica*, *Vaccinium Oxycoccus*, *Listera cordata*, *Lycopodium Selago*, *L. selaginoides* and several of the Montane mosses descend to their lowest stations, where they meet and mingle with such species as *Gentiana Pneumonanthe*, *Mentha Pulegium*, *Centunculus minimus*, *Spergularia rubra*, *Cerastium semidecandrum*, *Hypericum elodes*, *Radiola Millegrana*, *Ornithopus perpusillus*, and *Lycopodium inundatum*.

It is in the tract of the Middle Oolite that the characteristically Xerophilous species have their head-quarters. The following species are the most typical representatives of this category and are either absolutely or very nearly restricted in North Yorkshire to the scars and dry banks of the Middle Oolite, the Magnesian Limestone, and the Mountain Limestone, avoiding altogether or growing but very sparingly in the eugeogenous three-fourths of the area of the Riding.

LIST OF CHARACTERISTICALLY XEROPHILOUS SPECIES.

Comparatively frequent species:

Helleborus viridis	Spiræa Filipendula	Convallaria majalis
Aquilegia vulgaris	Pyrus Aria	Carex digitata
Actæa spicata	Carduus eriophorus	Sesleria cærulea
Hutchinsia petræa	Salvia verbenaca	Avena pratensis
Helianthemum vulgare	Calamintha officinalis	Bromus erectus
Hypericum montanum	Taxus baccata	Brachypodium pinnatum
Geranium sanguineum	Orchis pyramidalis	Hordeum sylvaticum.
Astragalus glycyphyllos	Ophrys apifera	
,, Hypoglottis	,, muscifera	

CHARACTERISTICALLY XEROPHILOUS SPECIES—*Continued.*

Local and less abundant species:

Anemone Pulsatilla	Galium erectum	Thymus Chamædrys
Draba muralis	Asperula Cynanchica	Calamintha Nepeta
Helianthemum canum	Inula Conyza	Epipactis ovalis
Linum perenne	Senecio campestris	Ceterach officinarum
Hippocrepis comosa	Carduus acaulis	Polypodium
Onobrychis sativa	Orobanche rubra	Robertianum.
Potentilla verna		

Of these forty-three species, fifteen are restricted to the West of the Central Valley and four to the East, but the remaining twenty-four grow both upon the east and the west of it. Of the distribution of the latter that of *Aquilegia vulgaris* will afford a fair average illustration.

So far as known to me the Wild Columbine grows in North Yorkshire as follows, excluding from consideration two or three stations where it is plainly a garden escape. Amongst the western hills in Swaledale in woods at the Round Howe and on the north side of the river near Applegarth, and in the Yore district in Fossdale Woods and Shaw Gill, Hardraw, in all these cases amongst the scars of the Yoredale Limestone; and also in Wensleydale by the Yore side about the Aysgarth rapids upon the Lower Scar Limestone. From the tract underlaid by the Millstone Grit series it is altogether absent. Where the Magnesian Limestone comes to the surface it grows in woods by the Wharfe side at Thorparch. It overleaps altogether the New Red Sandstone of the Central Valley and is absent also from the tracts underlaid by the Lias and the Inferior Oolite. Amongst the woods of the calcareous embankments of the hills of the Middle Oolite it grows plentifully in Yowlasdale, Beckdale and several other places about Helmsley and Hawnby and Pickering, in the Howardian tract in several stations, and in the dale of the Derwent near Hackness. From the Vale of Pickering it is altogether absent.

So that we have the plant growing more or less abundantly in all the tracts (see table at page 51) which are underlaid by the dysgeogenous beds, but entirely absent from the wide intermediate areas underlaid by the more porous and more humid strata. It follows the limestone from east to west through the irregularities of its dispersion and is entirely restricted to that fourth portion of the area of North Yorkshire to which the limestone is restricted. How closely the distribution of many of these Xerophilous species corresponds with that of *Aquilegia* a glance at what is said respecting them in the botanical portion of these notes will shew. The following species shew clearly a similar lithological restriction, but not in a manner so decidedly marked as in the case of those which have already been named.

LIST OF SUBXEROPHILOUS SPECIES.

Ascending Plants:

Arabis hirsuta	Dipsacus pilosus	Atropa Belladonna
Viola hirta	Scabiosa Columbaria	Origanum vulgare
Cerastium arvense	Lactuca virosa	Calamintha Acinos
Anthyllis Vulneraria	Carlina vulgaris	Lithospermum officinale
Rosa spinosissima	Campanula glomerata	Juniperus communis
Poterium Sanguisorba	Gentiana Amarella	Spiranthes autumnalis
Pastinaca sativa	Ligustrum vulgare	

Descending Plants:

Draba incana	Rubus saxatilis	Melica nutans.
Arenaria verna	Galium sylvestre	
Dryas octopetala	Gentiana verna	

In these two lists aboriginally native species only have been included and together they take in about one in thirteen of our indigenous flowering plants and ferns. When these species pass beyond the limits of the dysgeogenous fourth of North Yorkshire they always grow over dry sandy rock or dry sandy or gravelly detritus, avoiding the clayey and rich heavy soils. Next to the immediate neighbourhood of compact calcareous rock they evidently prefer stations where sand so loosely bound

together that water sinks readily through it predominates, a circumstance which indicates pretty conclusively that it is the dryness of the limestones rather than their chemical composition which is the chief source of attraction. Several of them are to be met with upon the coast sand-hills in the neighbourhood of Redcar: a few of them are found in the vicinity of the basaltic dike in Cleveland : more of them amongst the subcalcareous portions of the Inferior Oolite, as at Boltby and especially where in the Howardian tract the calcareous character of the interposed band is most clearly marked. Some of the commonest of the Subxerophilous species are scattered at intervals over the sandier parts of the Central Valley and may be found in such stations as the Ouse side along the Clifton Ings, the banks of the Swale at Topcliffe, of the Tees between Stapleton and Croft and the gravelly soils of the neighbourhood of Bedale and Kirklington.

M. Thurmann gives for the portion of Central Europe which includes the Vosges and the Jura both a list of the indigenous plants and an account of their distribution with regard to the subjacent rocks. Comparing the British flora as a whole with that of this region or indeed with that of any other part of the interior of Central or Southern Europe we see even by glancing over the mere list of names how conspicuously with us the damp-loving element predominates. When a British and Foreign Cybele is written, a work giving an account of the distribution of British plants through foreign countries and of the relation of our indigenous flora to that of Europe as a whole, this is one of the points which its author will have to explain to us and illustrate for us in detail. Out of fifty species which M. Thurmann gives as being within his limits the commonest plants which are characteristic of dysgeogenous tracts we have in North Yorkshire as indigenous plants eight species only : out of the fifty species which he names as the commonest plants which are characteristic of the eugeogenous tracts within his limits we have in North Yorkshire thirty-one species.

With us several of the most characteristically paludal plants which are common in the neighbourhood of York and Thirsk are altogether confined to the vales and nowhere ascend into the dales or amongst the lower levels of the hill-slopes. This is the case with *Thalictrum flavum*, *Nymphæa alba*, *Nasturtium amphibium*, *Cerastium aquaticum*, *Utricularia vulgaris*, *Hottonia*, *Hydrocharis*, *Sagittaria*, *Butomus*, *Potamogeton densus*, *Lemna trisulca* and several other species.

In Central Europe we have, as in North Yorkshire, ranges of hills of well-marked contrasting lithological character, the Jura dysgeogenous and the Vosges and Black Forest eugeogenous. The following are the thirty-one species which inhabit North Yorkshire which are given by M. Thurmann as characteristically eugeogenous. These are plants which ascend and are frequent amongst the eugeogenous Vosges and Black Forest but are either rare amongst or altogether absent from the dysgeogenous Jura, under parallel or nearly parallel conditions of atmospheric climate.

LIST OF NORTH YORKSHIRE PLANTS WHICH ARE CHARACTERISTICALLY EUGEOGENOUS IN CENTRAL EUROPE.

Orobus tuberosus	Stellaria holostea	Senecio sylvaticus
Prunus Padus	Trifolium fragiferum	,, aquaticus
Betula alba	Luzula multiflora	Spergularia rubra
Sarothamnus scoparius	Filago minima	Vaccinium Myrtillus
Quercus sessiliflora	Aira cæspitosa	Juncus squarrosus
Calluna vulgaris	Alopecurus pratensis	Meum athamanticum
Aira flexuosa	Triodia decumbens	Digitalis purpurea
Hieracium boreale	Rumex Acetosella	Galium saxatile
Ononis spinosa	Montia fontana	Saxifraga stellaris.
Jasione montana	Nardus stricta	
Hypericum pulchrum	Hypericum humifusum	

We see that we have in this list most or very nearly all the very species which make up the gregarious swamp-heatherland vegetation of which we have spoken as covering in our country such wide tracts of surface. These species are several of them our commonest North Yorkshire plants and ascend amongst

the moorlands of both lithological types, the difference for them as a class, being certainly, as has been already said, a greater degree of frequency and luxuriance in the eugeogenous tracts; but not such a restriction as we have seen there is in the case of the plants of the dry-loving category.

To sum up then the bearings of the subjacent rocks upon the topography of our North Yorkshire vegetation as tested by a comparison of the distribution of species within our limits and in the country respecting which M. Thurmann treats we may say:

1. As compared with the flora of Central Europe the flora of North Yorkshire is one of a predominantly damp-loving stamp.

2. The species which in Central Europe are restricted to dysgeogenous tracts only occur in North Yorkshire in small number and are there restricted lithologically in a similar manner.

3. The species which in Central Europe are restricted to eugeogenous tracts are many of them plants of North Yorkshire also: and under the more boreal and more humid climate grow abundantly and cover wide areas of surface, without keeping up any clearly-marked role of lithological restriction.

And this shows us clearly that the nature of the subjacent rock both may and does interfere to modify the influence of atmospheric climate upon plant-topography, and it points out also in what direction the interference operates. A more porous and more humid soil evidently to some extent compensates for a drier climate. In proportion as the climate is damper the characteristically dry-loving species are more and more rigidly restricted to dry-soiled tracts of country. This is the rule and in botanico-geographical considerations it is evidently worth bearing in mind: but to what extent it has operated in determining which species we should have and which we should not have either in North Yorkshire or in Britain as a whole; to what extent it has for instance operated in the restriction to the area which they occupy in our country of the plants of Mr. Watson's Germanic type of distribution we can but guess vaguely.

April 1888.

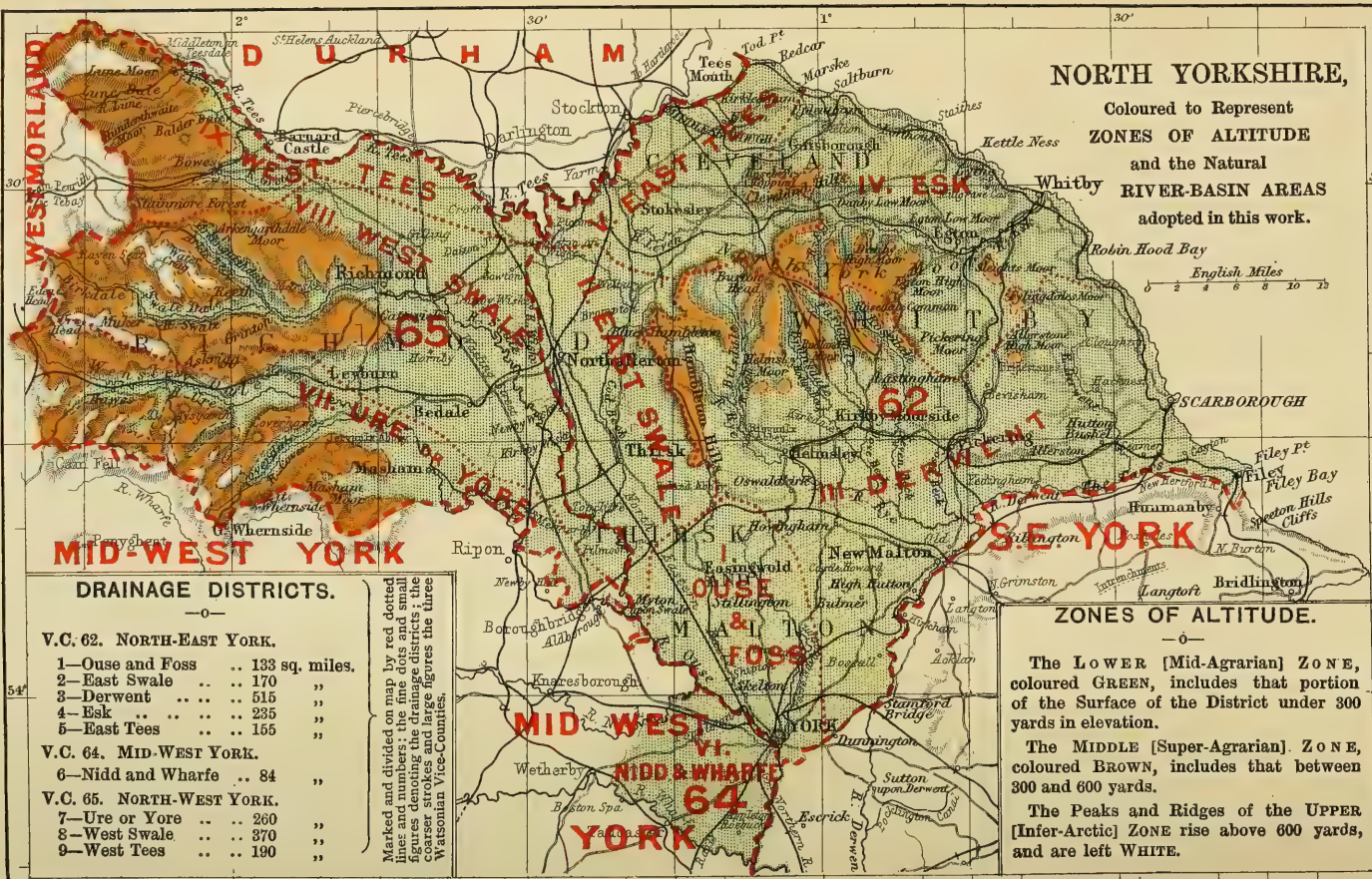
The rich bryological flora of North Yorkshire has its head quarters amongst the well irrigated porous-rocked eugeogenous hills and slopes.* To these nearly all the characteristically Montane species are restricted and amongst them most of the common mosses attain their greatest abundance and luxuriance. A few species, notably *Neckera crispa*, *Tortula tortuosa*, and *Trichostomum flexicaule* are common everywhere amongst the rocks of the dysgeogenous hills and almost entirely absent from the eugeogenous tracts. And what has been said of the mosses will apply with precision to the Lichens : a good list of species for North Yorkshire as a whole, the more northern species confined to, and the commonest species attaining their greatest abundance and luxuriance amongst the eugeogenous hills, a few species almost invariably associated with the calcareous rocks and almost confined to them.

The Precipices and Waterfalls.—The unequal waste of different kinds of rock is also worthy of attention in its bearing upon two conspicuous features of scenery. First, the precipices. Along a great part of the coast line, the cliffs have a compact arenaceous cap over a more or less considerable thickness of mainly argillaceous groundwork. In Whitstoncliff and the other scars of the Middle Oolite a mass of compact limestone rests upon a base of Oxford Clay, and we have seen how in the west, clays are interpolated between every band of the Mountain Limestone. The lower part of these cliffs wastes away faster than the upper. At first the upper part overhangs, becoming all the time gradually loosened by rains and frosts, till at last it becomes overbalanced and falls with a tremendous crash, strewing the hill-side or beach with its broken blocks. Lastly, the waterfalls. Here again the softer rocks are wasted away and those composed of less porous

* Though Teesdale is coloured as subdysgeogenous in the Map it can scarcely be considered as such without great exception and what is said above does not apply to it. In fact strata of both lithological types are in Teesdale so much mingled together that it presents the characteristics of both the types combined. It has the heatherland and swamps, the irrigated cliffs and gills, the rich bryology and lichenology of the eugeogenous hills and furnishes also upon the limestone and basalt many of the characteristically Xerophilous species.

and harder material remain. The numerous falls of Wensleydale are, with only one conspicuous exception, over the different bands of limestone: in the exceptional case, Millgill Force, the edge rock is one of the firm gritstones of the Yoredale series. Kisdon Force in Swaledale is over Limestone: the Caldron Snout, the High Force, and the falls of Maize Beck and Blea Beck over Basalt. Thomasson's Force and the other minor falls of Cleveland are over hard edges of Inferior Oolite. And almost invariably the fall is approached by a steep glen, which, in course of time, the stream has excavated, along the sides of which the cap-rock of the fall stands out in prominent relief.

CLIMATOLOGY.


NORTH YORKSHIRE,
Coloured to Represent
ZONES OF ALTITUDE
and the Natural
RIVER-BASIN AREAS
adopted in this work.
English Miles
0 2 4 6 8 10 12
DRAINAGE DISTRICTS.
—o—
V.C. 62. NORTH-EAST YORK.
1—Ouse and Foss .. 133 sq. miles.
2—East Swale .. .. 170 ,,
3—Derwent .. .. .. 515 ,,
4—Esk .. .. 235 ,,
5—East Tees .. .. 155 ,,
V.C. 64. MID-WEST YORK.
6—Nidd and Wharfe .. 84 ,,
V.C. 65. NORTH-WEST YORK.
7—Ure or Yore .. .. 260 ,,
8—West Swale .. .. 370 ,,
9—West Tees .. .. 190 ,,
Marked and divided on map by red dotted lines and numbers; the fine dots and small figures denoting the drainage districts; the coarser strokes and large figures the three Watsonian Vice-Counties.
ZONES OF ALTITUDE.
—o—
The LOWER [Mid-Agrarian] ZONE, coloured GREEN, includes that portion of the Surface of the District under 300 yards in elevation.
The MIDDLE [Super-Agrarian] ZONE, coloured BROWN, includes that between 300 and 600 yards.
The Peaks and Ridges of the UPPER [Infer-Arctic] ZONE rise above 600 yards, and are left WHITE.
DURHAM
WESTMORLAND
CLEVELAND
MID-WEST YORK
S.E. YORK
YORK
I. EAST TEES
II. WEST TEES
III. EAST SWALE
IV. ESK
V. DERWENT
VI. MID WEST
VII. URE OR YORE
VIII. WEST SWALE
IX. OUSE & FOSS
X. NIDD & WHARFE
65
62
64
Tees Mouth
Stockton
Darlington
Barnard Castle
Richmond
Leyburn
Bedale
Thirsk
Northallerton
Ripon
Whernside
Pen-y-ghent
Masham
Stokesley
Guisborough
Whitby
Kettle Ness
Robin Hood Bay
SCARBOROUGH
Filey Pt.
Filey
Filey Bay
Speeton Hills
Cliffs
Flamborough Head
Bridlington
Hunmanby
Kirkbymoorside
Helmsley
New Malton
Easingwold
Borobridge
Knaresborough
YORK
Wetherby
Boston Spa
Escrick
Sutton upon Derwent
Stamford Bridge
Dunnington
Langton
Malton
Pickering
Goathland
Middlesbrough
Redcar
Saltburn
Marske
Staithes
Loftus
Egton
Whitby
Ugthorpe
Sleights
Grosmont
Castleton
Danby
Lealholm
Glaisdale
Egton Bridge
Rosedale
Hutton Buscel
Ayton
Seamer
Scalby
Cayton
Gristhorpe
Muston
Yedingham
Wintringham
Sherburn
Hutton Cranswick
Wold Newton
Burton Agnes
Lowthorpe
Kilham
Langtoft
Driffield
Nafferton
Great Driffield
Middleton-in-Teesdale
St. Helens Auckland
Piercebridge
Croft
Yarm
Eaglescliffe
Middleton One Row
Aldbrough
Myton upon Swale
Stillington
Sheriff Hutton
Strensall
Haxby
Huntington
Earswick
Skelton
Overton
Beningbrough
Linton upon Ouse
Aldwark
Boroughbridge
Dishforth
Topcliffe
Thornton Bridge
Kirby Wiske
Arrathorne
Bedale
Crakehall
Jervaulx
Middleham
Leyburn
Wensley
Askrigg
Aysgarth
Carperby
Hawes
Gayle
Hardraw
Muker
Thwaite
Keld
Kirkby Stephen
Brough
Appleby
Barnard Castle
Bowes
Startforth
Greta Bridge
Rokeby
Egglestone
Mickleton
Lune Moor
Lune Forest
Baldersdale
Balder Head
Grassholme Reservoir
Hury Reservoir
Blackton Reservoir
Tan Hill
Stainmore Forest
Birkdale Common
Birkenhead Moor
Kisdon Hill
Great Shunner Fell
Wild Boar Fell
Swarth Fell
Whernside
Ingleborough
Penyghent
Fountains Fell
Darnbrook Fell
Cam Fell
Masham Moor
Hambleton Hills
Sutton Bank
Whitestone Cliff
Roulston Scar
Howe Hill
Boltby Scar
Cold Kirby
Thirlby
Osmotherley
Swainby
Scarth Wood Moor
Carlton Moor
Carlton Bank
Hasty Bank
Urra Moor
Cringle Moor
Botton Head
Danby High Moor
Danby Low Moor
Eskdaleside Cum Ugglebarnby
Glaisdale Moor
Egton High Moor
Egton Low Moor
Lilla Howe Moor
Fylingdales Moor
Pickering Moor
Levisham Moor
Newton Moor
Hutton Buscel Moor
Wykeham Moor
Brompton
Sawdon
Hackness
Harwood Dale
Silpho
Scalby Mills
Cayton Bay
Gristhorpe Bay
Filey Brigg
Speeton
Reighton
Flamborough
Bempton
Danes Dyke
Sewerby
Bridlington Quay
Bridlington Harbour
Barmston
Skipsea
Skipsea Brough
Atwick
Hornsea
Hornsea Mere
Aldbrough
Mappleton
Withernsea
Patrington
Spurn Head
Kilnsea
Easington
Hedon
Preston
Hull
Beverley
Market Weighton
Pocklington
Millington
Londesborough
Nunburnholme
Warter
Huggate
Fridaythorpe
Thixendale
Wharram Percy
Wharram-le-Street
Sherburn
Weaverthorpe
Helperthorpe
Luttons Ambo
Settrington
Duggleby
Langton
Kirby Grindalythe
Yedingham
Wintringham
Ganton
Scagglethorpe
Rillington
Thornton-le-Dale
Pickering
Kirkbymoorside
Gilling
Slingsby
Hovingham
Terrington
Oswaldkirk
Ampleforth
Coxwold
Byland Abbey
Kilburn
Hambleton
Thirsk
Sowerby
Topcliffe
Dalton
Thornton Watlass
Masham
Ilton
Swinton
Ripon
Studley Royal
Fountains Abbey
Harrogate
Knaresborough
Ripley
Pateley Bridge
Nidd
Scriven
Green Hammerton
Cattal
Kirk Hammerton
Whixley
Cowthorpe
Wetherby
Walton
Thorp Arch
Boston Spa
Bramham
Tadcaster
Sherburn in Elmet
Barkston Ash
Saxton
Lumby
Aberford
Garforth
Swillington
Methley
Castleford
Pontefract
Ferrybridge
Knottingley
Selby
Cawood
Wistow
Escrick
Riccall
Naburn
Acaster Malbis
Bishopthorpe
Dringhouses
Copmanthorpe
Askham Bryan
Askham Richard
Bilbrough
Appleton Roebuck
Bolton Percy
Kirkby Wharfe
Ulleskelf
Tadcaster
Towton
Saxton
Lumby
Aberford
Garforth
Swillington
Methley
Castleford
Pontefract
Ferrybridge
Knottingley
Selby
Cawood
Wistow
Escrick
Riccall
Naburn
Acaster Malbis
Bishopthorpe
Dringhouses
Copmanthorpe
Askham Bryan
Askham Richard
Bilbrough
Appleton Roebuck
Bolton Percy
Kirkby Wharfe
Ulleskelf
Towton
Tees Mouth
Redcar
Saltburn
Marske
Staithes
Kettle Ness
Whitby
Robin Hood Bay
Filey Pt.
Filey
Filey Bay
Speeton Hills Cliffs
Bridlington
Hunmanby
SCARBOROUGH
Flamborough Head
Bempton
Danes Dyke
Sewerby
Bridlington Quay
Bridlington Harbour
Barmston
Skipsea
Skipsea Brough
Atwick
Hornsea
Hornsea Mere
Aldbrough
Mappleton
Withernsea
Patrington
Spurn Head
Kilnsea
Easington
Hedon
Preston
Hull
Beverley
Market Weighton
Pocklington
Millington
Londesborough
Nunburnholme
Warter
Huggate
Fridaythorpe
Thixendale
Wharram Percy
Wharram-le-Street
Sherburn
Weaverthorpe
Helperthorpe
Luttons Ambo
Settrington
Duggleby
Langton
Kirby Grindalythe
Yedingham
Wintringham
Ganton
Scagglethorpe
Rillington
Thornton-le-Dale
Pickering
Kirkbymoorside
Gilling
Slingsby
Hovingham
Terrington
Oswaldkirk
Ampleforth
Coxwold
Byland Abbey
Kilburn
Hambleton
Thirsk
Sowerby
Topcliffe
Dalton
Thornton Watlass
Masham
Ilton
Swinton
Ripon
Studley Royal
Fountains Abbey
Harrogate
Knaresborough
Ripley
Pateley Bridge
Nidd
Scriven
Green Hammerton
Cattal
Kirk Hammerton
Whixley
Cowthorpe
Wetherby
Walton
Thorp Arch
Boston Spa
Bramham
Tadcaster
Sherburn in Elmet
Barkston Ash
Saxton
Lumby
Aberford
Garforth
Swillington
Methley
Castleford
Pontefract
Ferrybridge
Knottingley
Selby
Cawood
Wistow
Escrick
Riccall
Naburn
Acaster Malbis
Bishopthorpe
Dringhouses
Copmanthorpe
Askham Bryan
Askham Richard
Bilbrough
Appleton Roebuck
Bolton Percy
Kirkby Wharfe
Ulleskelf
Towton
2°
30'
1°
30'
1° W. of Greenwich
54°

CLIMATOLOGY.

I have thought it best to leave this chapter as it stood in the first edition and to add a supplement instead of making changes in the original text and tables.—J. G. B.

For numerous data and for information respecting various points not touched upon here reference may be made to the chapter on Climate in Phillips' 'Rivers, Mountains and Sea Coast of Yorkshire.' For a full account of the zones of altitude see Watson's Cybele Britannica,' vols. 1 and 4. The most complete and carefully prepared statistics which we have respecting the climate of different parts of England are those contained in he Quarterly Reports of the Registrar-general, the Meteorological portion of which was edited by Mr. Glaisher. From these nearly all the tables here used are taken.

Zones of Altitude.—In Watson's 'Cybele Britannica' the surface of Britain is considered as divided into two what are called 'Regions' of temperature; and each of these regions is subdivided into three what are called 'Zones.' The two Regions are divided from one another by the line of possible cultivation, which may be placed at about 600 yards in the North of England and declines to from 500 to 400 yards above the sea level in the North of Scotland. That portion of the surface which is above this line is called the Arctic Region, and what is below it is called the Agrarian Region, the three zones of each being respectively named Super-, Mid- and Infer-arctic, Super-, Mid- and Infer-agrarian. Divisions such as these may be employed with great advantage when we wish to indicate the broad general features of that important department of climate which is included under the head of temperature, and they are exceedingly useful to help the mind to connect together those districts which under a comparatively southern degree of latitude have their temperature lowered by elevation with those tracts which have a similar temperature under a more northern position. But at the same time, we must, in using them, be careful to remember that it is broad general similarities and contrasts only which they will enable us to express, and that each, by imperceptible stages of gradations, glides into those which come next to it in place.

April 1882.

The Infer-agrarian zone includes the lower levels of the surface in the country south of the estuaries of the Dee and the Humber, the Mid-agrarian zone the lower levels of the district which extends from these as far north as the estuaries of the Tay and the Clyde, and the Super-agrarian zone the lower levels of that portion of Scotland which is still unaccounted for. Above the limit of cultivation the three zones of the Arctic Region may be traced in ascending the loftier mountains of the north, a convenient line of demarcation being furnished by the upper limit of *Erica Tetralix* to bound the lowest of the three in an upward direction, and of *Calluna vulgaris* to separate the two others. Numbering these zones from one to six, beginning with the warmest, we may conveniently and at the same time comprehensively indicate the range of temperature which we possess within the limits of our field of study, as compared with that of Britain as a whole, by saying that we have in North Yorkshire three out of these six zones, the second, the third and the fourth, that the lowest levels of the surface are not warm enough to attain the comparatively southern temperature of the Infer-agrarian zone, nor its highest summits elevated enough to reach the comparatively colder temperatures of the two upper zones of the Arctic Region. These three zones then, we will adopt, and as there is no need to use long words where short ones will answer the purpose equally well, we shall speak of them throughout these notes simply as the Upper, the Middle and the Lower zone, the Upper being the Infer-arctic, the Middle the Super-agrarian, and the Lower the Mid-agrarian of the 'Cybele.'

Mean Temperatures in the Shade.—For York we have two thoroughly reliable sets of observations, in both cases made with instruments manufactured and corrected for special researches. The observations of the late Jonathan Gray extended from 1801 to 1825, three observations being taken daily and the results reduced to mean values by the proper tables. The observations of my valued friend John Ford at York have now extended over upwards of twenty years and are still (1863) continued. These

have been made with one of Mr. Cook's thermometers, duly compared with the Meteorological Society's standard, and the results obtained have been reported in Mr. Glaisher's tables since the commencement of their issue. The following table gives the result of both sets of observations and also the temperatures of Greenwich, Exeter, Leeds and Edinburgh, the latter all taken either direct or at second hand, through Mr. Lowe's tables in Morton's Cyclopædia of Agriculture, from Mr. Glaisher's reports.

MEAN TEMPERATURES IN THE SHADE.

Months.	York. J. Gray. 25 years.	York. J. Ford. 20 years.	Edinburgh. Horsburgh. 6 years.	Leeds. H. Denny. 10 years.	Greenwich. 89 years.	Exeter. Mr. Ellis. 8 years.
January.....	34·8	36·5	39·7	39·8	36·1	41·3
February	37·3	37·1	39·7	38·4	38·3	41·0
March	40·7	40·2	42·5	42·2	40·9	43·7
April.....	47·6	45·1	44·6	46·6	45·8	47·8
May	54·5	51·5	51·5	51·4	52·5	53·1
June	59·2	57·3	57·5	58·5	58·1	58·3
July	62·0	59·7	59·8	61·5	61·4	62·2
August	61·1	59·1	59·6	60·8	60·7	62·2
September ...	55·7	54·2	55·4	56·1	56·4	58·3
October	48·2	47·9	49·6	50·2	49·9	52·7
November ...	40·9	40·2	42·7	42·6	42·4	44·3
December.....	36·0	37·2	40·4	40·4	39·0	42·4
Mean of the whole year.	48·2	47·2	48·6	49·0	48·5	50·6

January, it will be observed, is according to both the authorities for York the coldest and July the warmest month of the year, and between these termini there is a regular advance and retrogression. If we divide the year into seasons of three months each, reckoning December, January and February to be the months of winter, and for York take the mean of the two rows of figures which have been given, we shall obtain the following result.

MEAN TEMPERATURE OF THE SEASONS AND THE WHOLE YEAR.

Locality.	Year.	Winter.	Spring.	Summer.	Autumn.	Difference between Summer & Winter.
Edinburgh	48·6	39·9	46·2	59·0	49·2	19·1
York	47·7	36·4	46·6	59·8	47·9	23·4
Leeds. . . .	49·0	39·5	46·7	60·3	49·6	20·8
Greenwich	48·5	37·8	46·4	60·1	49·6	22·3
Exeter . . .	50·6	41·6	48·2	60·9	51·8	19·3

The mean annual temperature of the coast of Cornwall is taken by Mr. Watson at 52, of the south coast of Devonshire at 51½, of Dorsetshire and Hampshire at 51, of Sussex at 50½, and of the south-east of Kent, in all these cases of the coast, at 50 degrees. The decrease in mean annual temperature along the eastern coast line of Britain amounts to only about 5 degrees of Fahrenheit's scale from south to north, that is to say, upon the average, one degree of temperature to two degrees of latitude. For slightly elevated localities in the interior of the country from London northward to Edinburgh the mean annual temperature is usually stated at from 47 to 49, 47 being about an average for the South of Scotland, 48 for the North of England and 49 for the Midland Counties, maritime stations being usually about one degree higher than inland places under the same parallels of latitude. The difference between Summer and Winter over the same tract is almost always between 20 and 24 degrees. As a general rule we may say that whilst towards the south-east of England as compared with York the annual means augment slightly and the summer temperatures more than the annual means, that towards the south-west the annual means mount still higher and especially that the winter is considerably warmer. In the interior of the country west of London the Summer is warmer, and the hiberno-æstival difference greater than at Greenwich. At Exeter we see that whilst the Summer is only one degree warmer than at York the Winter is 4 degrees warmer

and the hiberno-æstival difference is under 20°. According to Mr. Abbey's observations for Bradford, extending over a period of ten recent years, the mean annual temperature is 48·3, that of Summer 60·7 and that of Winter 36·3, which gives a hiberno-æstival difference just one degree higher than that of York. In the south-west of Cornwall the hiberno-æstival difference sinks down to 17 or 16, in Mr. Watson's East Highland province it is 21¼ upon the average of nine stations, and for the North coast of Scotland and its outlying islands upon an average of four stations it sinks to 15.

The difference between a *continental* and an *insular* climate, and the influence which proximity to the sea exercises in reducing the hiberno-æstival difference by cutting down the extremes both of Summer and Winter temperature, will be best shewn by a table of parallel data to those contained in our last table for a few stations selected in different parts of the European Continent. The temperatures are given upon the authority of Henfrey's 'Vegetation of Europe.'

TEMPERATURES OF THE YEAR, AND OF SUMMER AND WINTER UPON THE EUROPEAN CONTINENT.

Locality.	Mean of the year.	Summer.	Winter.	Difference between Summer and Winter.
Umea, Lapland	35	57	14	41
Stockholm	42	62	25	37
St. Petersburgh	38½	62	16	46
Moscow	38½	66	11	55
Copenhagen ...	47	64	31	33
Berlin	47	64	31	33
Hamburgh	48	64	32½	31½
Warsaw	48	68	30	38
Paris	51	65	38½	26½
Vienna.....	50	68	32	36
Geneva	50	63	35	28
Munich	48	65	30½	34½
Madrid	59	77	43½	33½
Milan	55	73	36	37
Naples.....	63	75	50	25

The surface of a sea, it is well-known, always becomes cooled and heated much less rapidly than the surface of the earth. The Gulf Stream carries across the Atlantic a current of heated water from subtropical to high northern latitudes. For Europe the north-east and the south-west are the two great contending winds, the former being the cold polar and the latter the warm equatorial current. And it is the modification which these influences combined exert in disturbing the normal relations of temperature to latitude that gives York a summer of Lapland and a winter of Northern Italy or, as we should perhaps rather say, Umea the summer of York and Milan the winter of York. And we have in the climate of Britain upon a small scale the same modification exemplified that we have in the climate of Europe upon a grand scale, the south-east more continental, the south-west comparatively insular in its range of variation, and the north of England intermediate between them.

At York the North-west, the wind which blows from the highest parts of the Pennine chain, is the coldest and the other two winds which conspicuously lower the temperature are, as might be expected, the North and the North-east. The North-east is the most prevalent wind in March, and it is frequent through April till July, but it would seem that before it reaches the vale of York its bitterness is somewhat broken by the eastern hills. The South-west for the year taken as a whole, is at once the warmest and most frequent of the winds. The West is the next highest in point of temperature and the East is high in Summer and Autumn; and these three with the South all upon the average elevate the temperature.

It is probable that the temperature of the rest of the low country throughout the Riding does not vary greatly from that of York; and that the differences which exist will be regulated by the exposure of any particular spot to the sun's influence and its position with regard to the hill masses. No doubt the temperature of the level part of Cleveland will be lower than that of York, bounded as it is by a range of high hills

on the south and open towards the north and east; and no doubt the temperature of the level country is, by the proximity of extensive tracts of moorland both upon the east and west, depressed to some extent below its proper average, and the temperature of the low part of North Yorkshire as a whole, is thus brought to be more upon an equality with the rest of the Mid-agrarian zone than it is with those parts of the Centre and South of England which the Infer-agrarian zone comprises.

We do not possess for any maritime and elevated stations within our limits any records of temperature which come near to those of York as regards the period of time over which they have extended. During a comparatively few years previous to 1863 Dr. Cooke and others made observations, under the auspices of the Meteorological Society, at Scarborough. At two stations upon the banks of the South Tyne with a difference in altitude above the sea of 1300 feet my valued friend Thomas Sopwith mounted sets of instruments in 1856. The most elevated of the two, Allenheads, is near the head of a branch of the South Tyne about ten miles from the nearest point of North Yorkshire, and some of the observations made there, as well as at his low-land station, I shall here appropriate. For York the temperatures for the decade of years ending with 1860 are considerably below the average which has been already stated and so I give these, the means, the average daily maxima and the average daily minima, along with those from Scarborough and Allenheads up to 1860, as summarised from Mr. Glaisher's tables* (See the table on the next page).

Scarborough and Allenheads, in the first place let us observe, are both shut out from the south-west in a way that will have the effect of depressing their temperatures below the point which they might be expected to reach under more favourable

* For each section there is in the reports sometimes a month left blank. These blanks will almost always arise in a course of meteorological registration through absence from home of the observer or pressure of other engagements. It will be understood that in all the tables the average is not always drawn from every month of every year indicated.

circumstances. Reckoning the decrease of temperature northward according to the formula which has been stated, 49 would be the isotherm of the North Yorkshire coast towns, but it seems likely that none of them really attain it within at least a degree. As regards average daily range, our table shows York and Allenheads to be nearly upon a par throughout the year, and it shews well what a great difference there is in this respect between an inland and a maritime station, especially in the Spring months. The difference between the mean daily range at Scarborough and York during the three months of Spring is within a fraction of six degrees.

MEAN TEMPERATURES IN THE SHADE.

Month.	YORK, 1849—60. John Ford.				SCARBORO', 1855—60. Dr. Cooke and others.				ALLENHEADS, 1856—60 T. Bewick.			
	Mean.	Average Daily Max.	Average Daily Min.	Average Daily Range.	Mean.	Average Daily Max.	Average Daily Min.	Average Daily Range.	Mean.	Average Daily Max.	Average Daily Min.	Average Daily Range.
January	36°8	40°6	32°2	8°4	38°6	41°6	34°5	7°1	34°7	38°8	29°8	9°0
February ..	36°8	41°2	30°4	10°8	37°5	39°9	33°5	6°4	34°9	40°0	30°4	9°6
March	39°1	45°6	33°0	12°6	39°9	43°7	35°9	7°8	35°7	41°8	31°2	10°6
April	43°5	52°0	36°9	15°1	42°2	47°3	38°3	9°0	38°5	46°7	34°6	12°1
May	49°1	57°4	41°4	16°0	47°7	52°5	43°3	9°2	44°6	55°3	39°1	16°2
June	54°5	64°4	49°1	15°3	53°3	60°7	47°9	12°8	50°6	60°8	45°3	15°5
July	58°4	67°0	51°9	15°1	57°4	64°1	54°3	9°8	54°1	63°4	48°8	14°6
August	58°1	66°4	52°1	14°3	58°3	63°6	54°4	9°2	54°4	63°3	49°7	13°6
September ..	53°4	61°3	46°8	14°5	54°4	58°5	50°5	8°0	49°5	58°9	45°7	13°2
October	45°2	53°3	41°3	12°0	49°4	52°0	45°5	6°5	45°0	50°8	40°2	10°6
November ..	41°0	45°8	36°1	9°7	43°8	45°9	40°7	5°2	38°4	43°7	34°2	9°5
December ..	38°3	42°2	32°7	9°5	39°6	41°6	35°6	6°0	36°5	41°6	31°9	9°7
Mean of Whole Year.	46°2	53°1	40°3	12°8	46°8	51°0	42°9	8°1	43°1	50°4	38°4	12°0

The difference in the distribution of temperature throughout the seasons of the year between the different places is also a point which must claim our attention. Dividing the year into seasons as before and taking for each station the mean of the three months we obtain the following result.

MEAN TEMPERATURES OF THE SEASONS AND THE YEAR.

SEASON.	YORK.	SCARBOROUGH.	ALLENHEADS.
WINTER	37·3	38·6	35·4
SPRING	43·9	43·3	39·6
SUMMER	57·0	56·3	53·0
AUTUMN	46·5	49·2	44·3
THE YEAR	46·2	46·8	43·1

We have here for Scarborough a hiberno-æstival difference of only 17½ degrees, the reduction, as compared with York, being effected by the lowering of the maritime temperature in Spring and Summer, whilst it is kept higher than at the inland station in Autumn and Winter. As compared with what it is at an inland station the warm weather is in fact postponed at the sea-side. The winter temperature is warmer at the sea-side than at an inland locality because the sea cuts off the excessive cold. The spring temperature is warmer at the inland station than at the sea-side, because the sea absorbs heat from the air to make up for what it has given out in winter. The summer temperature is warmer at the inland station than at the sea-side because the sea cuts off the excessive heat. The autumn temperature is warmer at the sea-side than inland through the sea then giving out the heat it has absorbed in summer. This variation and the cutting off of the daily means are the change as regards temperature which is brought about by a maritime situation.

For a difference in level of fully 400 yards between York and Allenheads a reduction of 3 degrees of mean annual temperature is under the average mark. The balloon experiments made under the auspices of the British Association for the Advancement of Science give a diminution of one degree of Fahrenheit's scale for 276 feet. For Central Europe Humboldt gives the diminution at one degree for 267 feet. The registers

kept at Bywell during exactly the same period as those at Allenheads give the mean annual temperature of that station at 48·3, a difference of 5·2 degrees for 1300 feet, which is exactly 1 degree for 250 feet. Dr. Dalton long ago stated the diminution for the hills of the North of England at 1 degree for every hundred yards of elevation, which for the air is probably not far from correct, and furnishes a convenient figure for calculation. Of course the rate at which temperature decreases upwards will depend greatly upon exposition and other modifying influences. A station in a sheltered dale will be much warmer than one upon an exposed plateau at an equal elevation. Temperature will decrease more rapidly upon an isolated peak than where there is a greater mass of hill, and at a more rapid rate, other things being equal, the higher we rise above the level country. The hiberno-æstival difference at Allenheads according to the preceding table is more like that of Scarborough than that of York. The difference between Allenheads and York, which is 3·1 upon the mean of the year, sinks to 1·9 upon the average of the winter, rises to 4·3 in the spring, continues at 4·0 during the summer, and sinks again to 2·2 in the autumn; and although two sets of observations brought into comparison must of necessity yield very insufficient grounds upon which to establish general conclusions, yet one would suppose á priori, and it also seems likely from other considerations, that the distribution of at any rate the dale temperatures throughout the seasons is after a manner intermediate between that of the open low inland country and the sea-side, and that like the sea-coast elevated masses of land cut off the extremes of the year and postpone its warmth. And it is worthy of notice also that the difference between the average daily maxima of Allenheads and York is nearly 1 degree greater than the difference between their average daily minima.

We must take then the average temperature of the sea-side at 47 or something over, with a hiberno-æstival difference of 17 or 18; of the low inland country at 46½ to 47½, with a

hiberno-æstival difference of from 20 to 23; and, taking 47 as the most likely basis to calculate from, estimate the temperature of the Lower Zone at from 44 or 45 to 47 or 47½, of the Middle Zone at from 41 to 44, and of the Upper Zone at from 39 to 41.

According to the observations of Mr. Abbey, made day by day during 1860, at Horton Hall near Bradford, as compared with the mean temperature of the air in the shade at a height of 4 feet from the ground, the mean temperature of the air in the shade at 8 feet was 1 degree, at 6 feet 0·5, at 3 feet 0·8, at 2 feet 2·1, at 1 foot 2·9, and upon the grass 4 degrees, in all these instances lower, and at 1 foot below the surface 1·6 higher.

Maxima and Minima in the Shade.—Under this head a table giving the highest and lowest temperatures registered in our own district and in other localities at the same time, will, I think, be more satisfactory than to take them as observed at different times. For the maxima I have taken the summer of 1859, for the minima the winter of 1860.

MAXIMUM AND MINIMUM TEMPERATURES IN THE SHADE.

Locality.	Maximum in the month of July 1859.	Minimum on the night of Dec. 25-26, 1860.	Difference between the two.
Helston	90·0	32·0	58·0
Ventnor	79·0	24·0	55·0
Greenwich	93·0	8·0	85·0
Derby	83·0	2·0	81·0
Nottingham ...	89·5	—8·0	97·5
Liverpool	82·0	16·2	65·8
Manchester.....	85·0	—3·0	88·0
Wakefield	90·0	—2·0	92·0
Leeds	90·0	6·0	84·0
Otley	.....	5·0	
Ben Rhydding...	.....	8·5	
Harrogate	.....	9·5	
York	82·0	—4·0	86·0
Scarborough ...	77·4	16·0	61·4
Allenheads	79·0	8·3	70·7
Bywell.....	85·5	3·5	82·0
North Shields...	81·4	6·8	74·6

The foregoing are all taken from the Meteorological Society's Reports. The following notes of minima refer to the same night and are taken from the list which appeared in the Gardener's Chronicle; but whether here in all cases the thermometers were accurate and properly hung may fairly be doubted.

Locality.	Minimum on the night of Dec. 25th, 1860.	Authority.
Mulgrave near Whitby	10·0	J. McLean.
Easthorpe	8·0	G. Legard.
Castle Howard	4·0	do.
Coneysthorpe.....	0·0	do.
Kirkham	— 2·0	do.
Bradford	— 3·0	Mr. Abbey.
Wakefield	— 6·0	Mr. Bell.
Doncaster	— 8·0	Doncaster Gazette.
Bedale.....	—11·0	Mr. Cox.
Thorp Perrow near Bedale ...	—12·0	Mr. Culverwell.
Newton House near Bedale...	—13·0	Mr. Turner.

The English and Welsh Counties in which, upon the authority of the same list, the thermometer sunk down to zero, or below, are Northumberland, Lancashire, Yorkshire, Cheshire, Staffordshire, Derbyshire, Nottinghamshire, Leicestershire, Cambridgeshire, Norfolk, Warwickshire, Suffolk, Brecknock, Hereford, Gloucester, Oxford, Berkshire, Buckinghamshire, Hertford, and Essex. Here we see well exemplified what has already been pointed out—how that the extremes of winter cold are cut off upon and near the coast in the south and west, and how that they are most extreme in the interior of the lowland country and in the east. Ben Rhydding, Harrogate, and Otley are all somewhat elevated stations in West Yorkshire, and at Allenheads the minimum does not fall so low as that of Bywell by 5, and as that of York by 12 degrees. The four stations to which Mr. Legard's observations relate are each within five miles of the others. Easthorpe stands upon the calcareous Howardian terrace at an elevation of 350 feet above the sea-level; Castle

Howard and Coneysthorpe both upon the arenaceous Inferior Oolite at 250 feet and 200 feet respectively, and Kirkham upon the Sandstone in the immediate vicinity of the Derwent at 50 feet lower than Coneysthorpe. The fall of temperature does not grow greater here as we ascend, but precisely the contrary. In Scotland the average minimum for the stations of the Meteorological Society in the low part of Aberdeenshire was 6 degrees below zero, but at Braemar and Castle Newe, in the upper portion of the county, it did not sink below 8 and 10. At Edinburgh the minimum was —6, but at Wanlockhead in Dumfriesshire, which is 1333 feet above the sea-level, it was 6. We shall have to speak further about the distribution of winter minima when we come to treat upon the topography of wild and cultivated plants.

Mean Temperatures in the Sun and upon the Ground.—The foregoing tables, it will be observed, all relate to the temperature of the air in the shade. But, especially under an unclouded sky in summer time, the direct action of the solar rays exerts a powerful heating influence, so that the average daily maxima of exposed places rise much higher than those which shaded positions reach. And at night the minimum of the ground is more or less below the minimum of the air. The following tables for Bywell and Allenheads give month by month in the first column the average excess of the daily maxima in the sun above those registered in the shade, and in the second the average fall of the nightly minima on the grass below those of the air. In the third for each locality the average daily range in the shade is given, and by adding to this the other two numbers we obtain in the fourth column the extreme range of the 24 hours, that is to say the average daily difference between the lowest point to which a thermometer placed upon the ground sinks down at night, and the highest point to which one that is fully exposed to the sun's rays in the day-time rises up.

EXTREME RANGE OF TEMPERATURE IN FULLY EXPOSED SITUATIONS.

	Bywell, 1857—1860. J. Dawson.				Allenheads, 1857—60. T. Bewick.			
Months.	Excess of average daily max. in the sun over those in the shade.	Fall of average daily minima on grass below those of the air.	Average daily range in shade.	Total Range.	Excess of average daily max. in the sun over those in the shade.	Fall of average daily minima on grass below those of the air.	Average daily range in shade.	Total Range.
January	3·0	6·1	10·9	20·0	3·1	1·6	9·0	13·7
February ..	7·8	7·2	12·3	27·3	7·1	2·3	9·6	19·0
March.....	13·6	6·1	12·7	32·4	15·1	1·6	10·6	27·3
April	17·3	7·2	13·8	38·3	20·4	3·6	12·1	36·1
May	23·1	7·3	15·5	45·9	30·4	3·5	16·2	50·1
June	21·7	7·3	14·5	43·5	28·4	3·0	15·5	46·9
July.....	22·8	8·6	14·4	45·8	24·7	5·3	14·6	44·6
August	20·9	9·1	14·4	44·4	25·1	4·9	13·6	43·6
September..	17·1	9·7	14·4	41·2	21·7	6·4	13·2	41·3
October	6·5	7·2	12·5	26·2	15·0	3·5	10·6	29·1
November ..	4·3	6·6	12·9	23·8	6·7	2·9	9·5	19·1
December ..	5·3	6·5	12·0	23·8	0·6	1·9	9·7	12·2
	13·6	7·4	13·4	34·4	16·6	3·4	12·0	32·0
Winter	5·4	6·6	11·7	23·7	3·6	1·9	9·4	15·0
Spring	18·0	6·9	14·0	38·9	22·0	2·9	13·0	37·9
Summer	21·8	8·3	14·4	44·6	26·1	4·4	14·6	45·0
Autumn	9·3	7·8	13·3	30·4	14·5	4·3	11·0	29·8

Here we see illustrated the immense power which the direct action of the sun exercises, a circumstance which, as Humboldt long ago remarked, it is very necessary that we should always remember to take into account when questions connected with temperature are under consideration. Comparing one station with the other we see that it is amongst the hills, where the air is thinner and lighter than in the low country, that the direct action of the sun produces the greatest effect; but then to counter-balance this, the cooling process also goes on there with the greatest rapidity. The average daily range of temperature in the shade is not conspicuously different at the two stations at any period of the year, but the fall upon the ground at night below the minimum of the air is notably the least throughout the year at the upland station, especially in Winter and Spring.

In fact, upon the average of the year the absolute minimum upon the grass is only lower at Alienheads than it is at Bywell by a fraction of a degree.

Area in North Yorkshire of the Three Zones of Altitude.— Recurring to our three zones of altitude we must next seek to ascertain what portions of the surface they respectively embrace and what are their characteristic features. The most suitable lines of limit would appear to be the contour lines which mark an elevation of 300 and 600 yards above the sea-level, that portion of the surface which is below 300 yards in elevation being considered as embraced in the Lower Zone, the moorlands and upper part of the dales which range in height between 300 and 600 yards making up the Middle Zone, and the summits of the peaks which rise above 600 yards the Upper Zone.

On the west the line of an elevation of 300 yards runs from the Tees at Winch Bridge within a short distance of the river as far as the Lune, up the Lune a little, round the edge of the fells above Romaldkirk, ascends Balderdale for a considerable distance, and thence is continued along the edge of Lartington Moor past nearly the head of Deepdale to the Greta near Bowes. From Bowes it curves considerably to the east to skirt the western bank of the dale of Gilling above Dalton and Kirkby Ravensworth, and then turns to the west round Richmond Beacon to near the Swale at Applegarth, curving round the lower part of the dale of Marske and again coming sharply down to the Swale in the angle between the main dale and Arkengarthdale. It ascends Arkengarthdale to the foot of Shaw Beck, runs down the west side not far from the Arkle Beck to Reeth Moor and from this point passes due westward not far from the Swale to Muker. South of the Swale it does not leave the river far as we proceed eastward from Muker to Downholme, and from thence it sweeps round the edge of Downholme Moor, Bellerby Moor and Leyburn Moor, runs along within a short distance of the Yore as far west as Thwaite Bridge above Hawes, and there turning again towards the east passes Gayle and beneath Bear's

Head, ascends Semerdale to above the upper end of the lake, ascends Bishopdale, Waldendale, and Coverdale to within a short distance of their head-passes, coming out boldly towards the Yore round the edge of the ridges which separate them, and within a few miles of Masham it sweeps round Middleham Moor and the Colsterdale hills to the Riding boundary. From this line to the western margin of the county all the surface is upwards of 300 yards in height.

Of the arenaceous oolitic hills of the east the Middle Zone includes a narrow ridge above Osmotherley and the summits of Ingleby Bank and Swainby Bank just reach it. On the north its boundary from Osmotherley Moor curves past the head of Scugdale to Faceby Bank and Carlton Bank and from thence runs down the edge of Bilsdale for some distance and curves round the head of Snailesworth to Osmotherley Moor again. Between the forks of Bilsdale it includes the peaks and from Burton Head embraces the ridge of watershed as far to the east as Rosedale and Fryupdale, with lateral ridges stretching out for some distance between the dales which open out towards the south. East of this principal area the peak of Lilla Cross just reaches it and the same may be said of Kildale Moor on the north; but of the wide extent of undulated country north of the Esk only the two peaks of Roseberry Topping and Danby Beacon and the ridge of Guisborough Moor are high enough to reach unto it.

Of the tabular calcareous hills of the east the Middle Zone includes the plateau from Black Hambleton southward by way of Kepwick Bank and Boltby Bank to Whitstoncliff and Rolston Scar, with a width at the north end of the ridge of fully two miles and extending eastward almost as far as the Rye. But towards the south the ridge which reaches into it becomes narrower and opposite Whitstoncliff is not more than a mile wide, and east of this Hambleton plateau only just the summits of Hawnby Hill and Easterside attain it.

Many of the western peaks reach into the Upper Zone but nowhere does it include a continuous area of even moderate extent. Between the Tees and the Lune it can claim the ridge from Cronkley Fell westward. Between Arkengarthdale and Swaledale Water Crag, Rogan's Seat and Pin Seat reach it. Round the head of the Swale a crescent ridge rises into it which extends from Raven Seat Moor round the head of Whitsundale and Swaledale to Ladies' Pillar, six principal peaks connected together by a narrow neck of elevated land. Between Swaledale and Wensleydale it includes the summits of Yore Head, Shunnor Fell, and Lovely Seat, with a spur from this last towards the east. West of Widdale it includes a ridge about three miles in length and at the head of the dale Wold Fell just reaches it. South of Wensleydale it embraces a long narrow ridge from the head of Widdale eastward to the head of Bishopdale, with lateral spurs between each of the dales towards the north and a northern outlier in Bear's Head. And lastly it includes a ridge between Coverdale and Colsterdale, of which Buckden Pike and Great Whernside are the peaks, with a northern outlier which stands boldly out towards the main dale in Penhill.

Probably we shall not be far wrong if we estimate that the Upper Zone includes altogether some 20 square miles or about one per cent. of the whole surface of North Yorkshire: the Middle Zone about one-fourth or one-fifth of it: and the Lower Zone the remaining portion or about three-fourths of the whole.

Characteristics of the Zones of Altitude.—There is a scar of the Main Limestone upon the western edge of Mickle Fell at an elevation of from 750 to 800 yards above the sea-level, and upon its summit ridge at an elevation of 800 yards and upwards a number of rocky 'swallow holes' in the recesses of which grow a few ferns and other shade- or damp-loving plants. There is a sort of limestone pavement like that of Craven, but upon a much less extensive scale, which rises into the Upper Zone upon Widdale Fell and Cam Fell, and this is also the case with

one or two prominent 'edges' of gritstone in the tract of the great synclinal depression of the Carboniferous beds. With these exceptions the surface of the Upper Zone consists entirely of the swells of the highest undulations of the moorlands, sometimes grassy, but more often a combination of heath and turfy swamp.

The main dales of the west usually terminate at about 400 yards, the slope at their upper part from 400 to 550 or 600 yards being generally abrupt, but of course the mere water-channels run down from the fell tops. The summit of the Stainmoor Pass is under 500 yards in elevation: that which leads out of the head of Swaledale is a little over 550 yards and that between Arkengarthdale and Gretadale is about 500 yards. At the head of Wensleydale the passes are lower: that which leads into Garsdale is only 350 yards in height: that which leads into the dale of the Eden is a trifle over 400 yards: and that which leads out of Widdale into Dentdale and Ribblesdale is a little under 450 yards. Towards the south they are loftier: the summit of the road to Langstrothdale from Bishopdale is 500 yards in elevation and that from Coverdale is nearly 50 yards higher still, whilst between Swaledale and Wensleydale the Buttertubs Pass almost reaches the boundary of the Upper Zone. Of the passes between opposite dales of different drainage systems amongst the eastern moorlands only a few reach the Middle Zone, that between Scugdale and Snilesworth, those which cross the Hambleton plateau and those of the highest part of the ridge of watershed between Esk and Derwent, the rest being all under 300 yards.

Throughout both the two lower zones cliffs and rocky banks are frequent amongst all the hilly tracts and their slopes and along the line of the sea-coast. Even in the Lower Zone there is a wide extent of uncultivated heatherland both upon the east and west of the central valley; and of course this is the case to a much greater extent in the Middle Zone. Small tracts of uncultivated heath descend in some places to the lower levels

of the central valley, but these are growing gradually smaller and fewer, and now fully one-third of its area is occupied by arable land. The royal forest of Galtres, which extended from York to the Howardian hills and from the Derwent to the Ouse, was disforested in the reign of Charles the Second, but several what are called 'carrs,' boggy pieces of ground more or less overgrown with trees and brushwood, still remain in the central valley undrained. The main body of the most elevated towns of the three western dales, Middleton, Muker, and Hawes, is in each case at 300 yards or somewhat under. The only village which I remember that attains 350 yards is Keld in Swaledale. In Cleveland I do not know of any house so high as 300 yards. There is an inn upon the Hambleton plateau considerably above 350 yards and numerous scattered farm-houses at 400 and up to 450 yards in all the three dales of the west. In Gretadale the 'Spital' at the summit of the Stainmoor Pass is 1,450 feet above the sea-level, in Swaledale Crook Seat and two or three other farmhouses attain or exceed 500 yards, and there is an inn and two other houses near the Tanhill coalpit at 1,600 feet. There is a shooting-box upon Askrigg Moor at 550 yards and another upon the edge of the eastward spur of Lovely Seat not much under 600 yards, but above this I have not noticed anything but mere temporary sheltering places for shepherds and miners.

Though trees are tolerably abundant in most parts of the valleys* both in hedgerows and in woods, yet except in some of the carrs and occasionally by the stream-sides we cannot safely regard them as indigenous in such situations. Woods are much more plentiful in the dales and amongst the lower levels of the slopes than in the low country apart from the hills, and both by the stream-sides and amongst the banks and cliffs of the eastern and western ranges of moorland they are in many cases evi-

* Here as almost uniformly throughout these notes I use the words *valleys* and *dales* in contra-distinction to one another; meaning by the former the vale of Pickering and the vale of York; by the latter the dales of all the hilly tracts.

dently of aboriginal growth. Amongst the calcareous scars of the west and upon the steep banks of the dales of the calcareous hills of the east are the thickest and most extensive aboriginal woods which we possess. Respecting the altitudinal range of the indigenous trees details will be given afterwards. The Juniper and Rowan ascend the highest and just reach the upper limit of the Middle Zone. Above the Lower Zone thick woods are rare and such as may be seen are often planted woods of Larch and Spruce and Scotch Fir. Of the other trees which are most usually planted the Horse-Chesnut and *Populus balsamifera* both ascend to 350 yards. There is a natural wood above Whitfield Gill near Askrigg at an elevation of 500 yards and upwards and a plantation of larches on Askrigg Moor at 550 yards.

The highest hawthorn hedge which I know is a little above 350 yards, and they are comparatively rare above 200 or 250 yards, the roads and fields amongst the moorlands being generally bounded by stone walls. In favourable situations in the low country the yield of Potatoes is 120 to 150 bushels per acre; of Wheat 4 to 6 quarters and exceptionally 8; of Oats 6 to 9 quarters and exceptionally 10 or even 12; and of Barley 6 to 7 quarters and exceptionally 8. *Hordeum hexastichon* is cultivated but rarely and I am not aware that *Avena strigosa* is grown at all. Rye also is but rarely grown. The other cultivated crops of the low country are Turnips, Flax, Beans, Peas (*Pisum arvense* and *P. sativum*), Mangold Wurtzel, and *Brassica Napus*. Chicory is grown principally in the neighbourhood of York and a field of *Dipsacus fullonum* is to be seen occasionally. For forage *Vicia sativa*, *Trifolium pratense*, *T. repens*, and *Medicago lupulina* are principally planted, and occasionally *Trifolium incarnatum* and *Onobrychis sativa*; and of the Grasses *Lolium italicum* and a host of others. Upon the argillaceous soils of Cleveland the yield of Potatoes is from 150 to 200 bushels per acre; of Wheat 3 quarters and of Oats and Barley 4 quarters each. Wheat succeeds best in the central valley and is very

little grown above 200 yards. The highest field which I remember to have seen was above Aysgarth at a little under 300 yards, and upon the Hambleton plateau above this elevation it succeeds so badly as to make it not worth growing.* On passing up the three dales of the west very few cultivated fields are seen above Romaldkirk, Reeth, and Aysgarth, the western portion of North Yorkshire being entirely a mining and grazing tract. The western dales are celebrated for their short-horned cattle and cheeses, Cleveland for its horses. In the Middle Zone altogether there is probably under 20 square miles of arable land. Upon the Hambleton plateau there are numerous fields at 350 yards and upwards, but I do not know of any which attain quite 400 yards. Here Oats are grown at the rate of 4½ to 6 quarters per acre and Barley at the rate of 4 or 5 quarters, but occasionally it happens, as was the case with some of the fields in 1860, that the grain does not ripen and the crop has to be used for fodder. Potatoes and Turnips are also cultivated in fields upon the plateau. In the western dales small patches devoted principally to Potatoes may be seen up to 400 yards.

Upon the Hambleton plateau the highest garden which I know is upon the contour-line of 300 yards. Here Apples, Gooseberries, and Red Currants are grown, and in the kitchen garden Potatoes, Cabbages, Cauliflowers, Carrots, Beans, Red Beet, Onions, Parsneps, and *Pisum arvense* and *P. sativum*. I know of only one good garden which is clearly within the Middle Zone, and that is at 350 yards at Keld in Swaledale. Here are grown Apples, Cherries, Gooseberries, Rasps, Red, White and Black Currants, Strawberries, and two species of Rhubarb, and in the kitchen portion of it Carrots, Turnips, Peas, Beans, Potatoes, Cabbage, Cauliflower, and Broccoli.

* Dr. James Stark places the limit of the Wheat region in Scotland at the line of the Summer temperature of 56° Fahr. On the west coast of Scandinavia Wheat ascends to the 64th, Oats to the 65th, Rye to the 67th, and Barley to the 70th parallels of latitude. In the South American plateaux the culture of grain ceases at a mean annual temperature of 22½ degrees above the freezing point, in Switzerland at 9 degrees above it, in North Yorkshire at 11 or 12 degrees above it, whilst in Scandinavia it is carried on where the isotherm is at the freezing point or below it.

The three latter cannot be kept through the Winter and the Apple and Cherry trees, though they grow vigorously, do not fruit freely. Parsley, Beet, Onions, Sage, and *Mentha viridis* are grown up to 350 yards in other places and in a small patch enclosed from the moor at Tanhill at 1,600 feet, Potatoes, Common Rhubarb, Cabbages, Turnips, Parsley, Onions, Cress, and *Sinapis alba* have been cultivated. The Pear is grown up to 300 yards against walls and the Plum tree up to 250 yards. The following is a complete list of all the ornamental shrubs known to me as cultivated at 350 yards or upwards :

Cytisus laburnum, *Rosa rubiginosa*, *R alba*, *R. centifolia*, *R. indica*, *Cydonia japonica*, *Fuchsia magellanica*, *Berberis ilicifolia*, *Ribes sanguineum*, *Hedera Helix*, *Sambucus nigra*, *Ilex Aquifolium*, *Syringa persica*, *S. vulgaris*, *Ligustrum vulgare*, *Solanum Dulcamara*, *Lycium barbarum*, *Daphne Mezereon*, *Buxus sempervirens*.

The following horticultural data refer to the most favourably situated portions of the low country and illustrate principally the power of the heats of summer. The Apricot ripens so as to produce a fair crop once in two years. At Thirsk several trees are trained against the sides of the houses in the public streets, and in a favourable year the fruit has been sold in the market at the rate of a shilling per score. The Black Cluster Vine produces eatable fruit in the open air except in unusually unfavourable years, but the Sweet Water does not succeed. The Walnut in favourable situations will ripen its fruit every other year. The Hop fruits but rarely in the open air. The Spanish Chesnut does not fully ripen its fruit upon the tree, but usually the nuts though small are quite eatable after they have been kept for a fortnight. Figs will not unfrequently ripen in the open air against a south wall, but the trees require protection in Winter. The Peach and Nectarine are cultivated successfully ; in 1860 some of the trees at Thirsk trained against a wall with a southern exposure were pronounced by the lessee of the Hampton Court gardens to have as fine fruit as his own,

but these were killed by the ensuing severe winter. The Mulberry will not ripen every year as a standard but will usually do so when trained against a wall with a southern exposure. In Cleveland the Vine and Spanish Chesnut do not ripen their fruit in the open air, and the Mulberry hardly ever, but the Peach, Nectarine and Apricot usually ripen their fruit against brick walls with a southern exposure.

Perhaps the best horticultural test of the power of the colds of winter is furnished by the ornamental shrubs, and here there does not seem to be any appreciable difference between the Cleveland low country and the Central valley. The following list applies to both of these tracts, and contains the names of some of the commonest shrubs which are what the gardeners call 'half-hardy,' that is, are liable to be cut down and destroyed by the frosts of winters which are somewhat colder than usual:

Arbutus Unedo, *Jasminum revolutum*, *Cistus ladaniferus*, *Buddlea globosa*, *Genista florida*, *Deutzia gracilis*, *Magnolia grandiflora*, South European fruticose *Cytisi*, *Tamarix gallica*, *T. germanica*, *Rhododendron arboreum*, *Cryptomeria japonica*, *Pinus excelsa*, *Laurus nobilis*, *Viburnum Tinus*, *Garrya elliptica*.

The minimum temperatures reached in various localities both within and beyond our limits during the severe weather of the Christmas of 1860 have already been stated. The following list applies to the North Yorkshire portion of the vale of York and is an attempt at horticultural appraisement of this unusually severe frost as tested by its influence upon trees and shrubs:

KILLED.—Standard Asiatic Roses, Peach, Nectarine, Araucaria, Deodar, Mulberry, Ivy, Holly, Oak, Aucuba, *Prunus laurocerasus*, *P. lusitanica*, *Laurus nobilis*, *Viburnum Tinus*, Vine, *Quercus Ilex*, *Q. Suber*, Walnut.

INJURED.—Privet, Gorse, Broom, *Robinia Pseudacacia*, Fuchsia, Apple, Pear, Platanus, Medlar, Yew, Laburnum, Dog-Rose, Whitethorn.

UNINJURED.—Hazel, Ash, Birch, Beech, Lime, Alder, Poplars, Willows, Sycamore, Guelder Rose, Elm, Cherry, Wellingtonia, *Berberis ilicifolia*.

The summer of 1860 was unusually cold, sunless and humid, and this no doubt had a powerful influence in determining the effect upon vegetation of the winter which ensued, so that no doubt we may for all ordinary purposes regard the foregoing as representing a maximum of injury. Often only the young wood of trees and bushes in the 'killed' list was injured, but nothing has been included therein upon the faith of single or isolated cases. At Howsham one or two Beech trees, and in the vale of Pickering several Ash trees were considerably injured, and at Hildenley and elsewhere *Acer campestre*, and in the neighbourhood of Driffield several fine old trees of *Salix alba* and *Populus nigra* were destroyed. The damage to the latter-named species in the 'injured' list was inconsiderable, but the three first were cut down to the ground in many places.

In reply to my enquiry respecting the influence of proximity to the sea upon the cultivation of ornamental trees and shrubs, especially as tested by the Christmas of 1860, my friend W. Mudd, of Great Ayton, writes in substance as follows. 'Start from Marton and skirt the country by way of Ormesby, Eston, Lazenby, Wilton, Kirkleatham, Skelton, Lofthouse, Hinderwell, and Mulgrave Castle to Whitby, and I believe that between this line and the sea vegetation generally will be found fully two weeks in advance of the inland Cleveland country. As a general rule most trees and shrubs thrive better upon the inland than upon the seaward side of it. In the months of February, March, and sometimes April, the North, North-east, and East winds often what we call 'break' upon the edge of the hills and sweep the low country, cutting the tender shoots of trees and bushes both near the sea and in the interior. Along the line *Laurus nobilis*, *Pinus excelsa*, and *Cedrus Deodara*, thrive and have stood the severe frosts, but they are killed both upon the

inland and sea-ward side of it. In dry situations at Ayton* facing the south *Aucuba japonica* stood the frosts of 1860, but it was generally killed both inland and near the sea. *Prunus lusitanica* and *P. lauro-cerasus* were very slightly injured at Ayton, but at many places upon the line they were cut to the ground. The Holly was also cut to the ground upon the line, but inland Oak, Holly and Ivy were but little injured.'

We see above that in sheltered places near the sea some of the half-hardy shrubs of the low inland country can be grown successfully. This is the case at Scarborough with *Laurus nobilis* and *Jasminum revolutum*. The cutting off of winter minima in sheltered places amongst the hills is fully borne out by horticultural data. Of the shrubs cultivated at Keld the only one which was injured in 1860 was *Cydonia japonica*. In Cleveland only the Araucaria and the Deodar were killed, and whilst most of the species mentioned in the 'killed' list for the central valley were injured, those mentioned in the 'injured' list were hardly harmed at all. In the lower part of Wensleydale the damage was comparatively trifling, and the same was the case upon the arenaceous Howardian terrace at Terrington and upon the south side of the dale of the Wharfe at Harewood. Upon the magnesian limestone at Knaresborough *Cryptomeria japonica*, *Cedrus Deodara* and *Garrya elliptica* were not injured. If we make the circuit of the eastern range of moorlands we shall find almost always that where there are parks and gardens upon the hill-slope, some of the half-hardy shrubs of the low country are grown successfully. This is the case in Cleveland with *Laurus nobilis*, *Pinus excelsa* and *Cedrus Deodara*, all of which stood the Christmas of 1860 in Kildale and at Ingleby Manor and Busby Hall. *Viburnum Tinus* thrives at Oswaldkirk and *Laurus nobilis* at Castle Howard much better than in the low country. At Mount St. John there is a tree of *Laurus nobilis* 15 feet in height and *Garrya elliptica*

* Ayton is situated at the foot of the slope towards the south of the basaltic ridge, which somewhat protects it from the north.

succeeds well, but neither of them thrive at Thirsk, which is from 450 to 500 feet lower. We cannot emulate at Thirsk the luxuriant Roses of Coxwold and Rievaulx, climbing the wall sides of the cottages and wreathing round the windows of the upper storeys, and in Autumn the Dahlias and other tender herbaceous plants are often cut down by frosts at Thirsk before they are reached upon the hill-side. Of the wild plants killed or seriously injured by the frosts of 1860 the Broom ascends to 300, the Oak and Furze to 400 and the Ivy and Holly to 450 yards amongst the hills.

A note by my friend James Backhouse, respecting the effect of the same frost upon a Deodar at York is also worth quoting for the sake of its climatic bearing. The first two feet of the tree above the snow were quite killed ; at four feet it was comparatively little injured ; and at seven feet it was as fresh as it was where the snow completely protected it.

Ascending and Descending Wild Plants.—By far the greater number of the wild plants which we possess are most plentiful in the low country and become less frequent and finally run out as we ascend. The flowering plants and ferns to which this does not apply, the *Descending* or *Montane* species, such as are most plentiful amongst the hills and either altogether absent from or less frequent in the vales, are 86 in number. In the following list these are arranged under three classes and are further arranged under each class according to their lines of limitation in a *downward* direction, so far as these are known to me.

Class A.—Species confined exclusively to the western moorlands and slopes. Total 46.

850 Yards. *Carex rigida.*
750 ,, *Myosotis alpestris.*
600 ,, *Dryas octopetala.*
550 ,, *Polygala austriaca.*
500 ,, *Pyrola secunda.*

400 YARDS. *Thalictrum alpinum*, *Rubus Chamæmorus*, *Saxifraga Hirculus*, *Epilobium alsinifolium*, *Gentiana verna*, *Tofieldia palustris*, *Elyna caricina*, *Carex capillaris*, *Polypodium calcareum.*

350 „ *Saxifraga stellaris*, *S. aizoides*, *Meum Athamanticum*, *Arbutus Uva-ursi*, *Poa Balfourii.*

300 „ *Draba incana*, *Potentilla alpestris*, *Pyrus Aria*, *Saxifraga hypnoides*, *Hieracium anglicum*, *H. pallidum*, *H. iricum*, *H. prenanthoides*, *Bartsia alpina*, *Melampyrum sylvaticum.*

250 „ *Thlaspi alpestre*, *Potentilla fruticosa*, *Equisetum umbrosum*, *E. variegatum.*

200 „ *Hutchinsia petræa*, *Sedum villosum*, *Galium sylvestre*, *Polygonum viviparum*, *Sesleria cærulea.*

150 „ *Arenaria verna*, *Crepis succisæfolia*, *Hieracium corymbosum.*

100 „ *Ribes petræum*, *Galium boreale.*

Below 100. *Thalictrum flexuosum*, *Salix phylicifolia.*

CLASS B.—Species common to the moorlands and slopes of both east and west or confined exclusively to those of the east. Total 20.

300 YARDS. *Allosorus crispus.*

250 „ *Hieracium crocatum.*

200 „ *Habenaria albida*, *Carex pauciflora*, *Asplenium viride*, *Lycopodium alpinum.*

150 „ *Viola lutea*, *Geranium sylvaticum*, *Cornus suecica*, *Hieracium gothicum*, *Carduus heterophyllus*, *Vaccinium Vitis-idæa*, *Trientalis europea.*

100 „ *Rubus saxatilis*, *Hieracium murorum*, *H. cæsium*, *Gnaphalium dioicum*, *Melica nutans*, *Polypodium Dryopteris.*

Below 100. *Salix nigricans.*

CLASS C.—Species which have their head-quarters amongst the slopes and moorlands, but which descend into the valleys, (all below 100 yards). Total 20.

Trollius europæus, *Drosera anglica*, *Stellaria nemorum*, *Epilobium angustifolium*, *Ribes alpinum*, *Myrrhis odorata*, *Crepis paludosa*, *Vaccinium Oxycoccus*, *Pyrola rotundifolia*, *P. media*, *P. minor*, *Myosotis sylvatica*, *Primula farinosa*, *Rumex aquaticus*, *Empetrum nigrum*, *Listera cordata*, *Scirpus pauciflorus*, *Polypodium Phegopteris*, *Lycopodium selaginoides*, *L. Selago.*

For the Flowering Plants and Ferns this gives a proportion of about one-twelfth to the Montane element in our flora as tested by number of species. If we include the Mosses in the calculation the proportion is doubled, and we have about 220 Montane species out of a total flora of 1300 species, as will be shewn in detail hereafter. As we ascend from the low country amongst the hills the number of species gradually diminishes, the Montane species which are added never compensating in number for the Ascending species which cease. According to my present notes respecting the vertical range of our indigenous Flowering Plants and Ferns we have out of 100 species, at the coast level and below 100 yards 86, at 200 yards 64, at 300 yards 50, at 400 yards 37, at 500 yards 27, at 600 yards 17, at 700 yards 11, and at 800 yards 7. But in considering this proportion in connection with climate we must be careful to remember that, as we have already seen, we have as we ascend step by step, not only lower temperatures, but also a more restricted area of surface and a more restricted range of situation. A large proportion of the species, as their localities beyond our limits indicate, are not prevented by causes connected with temperature from ascending to levels much higher than we anywhere possess them. This applies more especially to those which ascend into the two upper zones. The following lists contain a selection of species arranged according to their ascending limits. I have given them in leaps of 100 yards, twelve to each gradation.

100 YARDS.—*Thalictrum flavum*, *Reseda lutea*, *Bryonia dioica*, *Scleranthus annuus*, *Convolvulus arvensis*, *C. sepium*, *Gentiana Pneumonanthe*, *Lycopus europæus*, *Scrophularia aquatica*, *Nepeta Cataria*, *Ballota nigra*, *Hordeum pratense.*

200 YARDS.—*Reseda luteola*, *Malva rotundifolia*, *Epilobium hirsutum*, *Berberis vulgaris*, *Eupatorium cannabinum*, *Pulicaria dysenterica*, *Erythræa Centaurium*, *Solanum Dulcamara*, *Myosotis palustris*, *Linaria vulgaris*, *Salix fragilis*, *Lastrea spinulosa*.

300 YARDS.—*Barbarea vulgaris*, *Cardamine amara*, *Silene inflata*, *Arenaria trinervis*, *Geranium dissectum*, *Acer campestre*, *Trifolium procumbens*, *Rubus fruticosus*, *Cornus sanguinea*, *Rumex conglomeratus*, *Glechoma hederacea*.

400 YARDS.—*Cerastium glomeratum*, *Hypericum quadrangulum*, *Ulex europæus*, *Lotus major*, *Agrimonia Eupatoria*, *Hieracium boreale*, *Scrophularia nodosa*, *Stachys sylvatica*, *Polygonum aviculare*, *Quercus Robur*, *Carex hirta*, *Equisetum Telmateia*.

500 YARDS.—*Orobus tuberosus*, *Prunus spinosa*, *Cratægus Oxyacantha*, *Rosa spinosissima*, *R. villosa*, *Parnassia palustris*, *Lonicera Periclymenum*, *Hedera Helix*, *Fraxinus excelsior*, *Mercurialis perennis*, *Ulmus montana*, *Lolium perenne*.

600 YARDS.—*Sagina nodosa*, *Anthyllis Vulneraria*, *Pyrus Aucuparia*, *Apargia hispida*, *Tussilago Farfara*, *Valeriana officinalis*, *Veronica Beccabunga*, *Primula vulgaris*, *Betula alba*, *Populus tremula*, *Corylus Avellana*, *Juniperus communis*, *Pteris aquilina*.

Critical plants and doubtful natives again excluded, thirty-five of the Ascending species have in Britain their north limit in North Yorkshire. Four of these are confined to the coast, *Medicago denticulata*, *Vicia bithynica*, *Hippophae rhamnoides* and *Salicornia radicans*. Six are confined to the central vale and do not pass north of the neighbourhood of York, *Viscum album*, *Carex paradoxa*, *Veronica triphyllos*, *Alopecurus bulbosus* and *Carduus pratensis*. Five more are confined to the valleys and do not pass north of the neighbourhood of Thirsk, *Carex pseudocyperus*, *Rumex palustris*, *R. maritimus*, *Potamogeton flabellatus* and *Polygonum mite*. Four more are confined to the valleys but pass north of Thirsk, *Teucrium Scordium*, *Nasturtium amphibium*, *Cerastium aquaticum* and *Eriophorum gracile*. Two species,

Chlora perfoliata and *Anemone Pulsatilla* ascend to the Magnesian Limestone. Four species ascend to 50 or 100 yards in the dales, *Campanula patula*, *Epilobium roseum*, *Rumex pratensis*, *Carex axillaris* ; and one, *Orobanche elatior*, to 100 yards upon the limestone. *Carex divulsa* and *Lamium Galeobdolon* ascend to 150 yards in the dales ; *Galium erectum*, *Dipsacus pilosus* and *Brachypodium pinnatum* to about the same height on the limestone. *Acorus Calamus* ascends to about 200 yards on the non-calcareous, *Carex digitata* to 250 yards on the calcareous, *Festuca pseudo-myurus* and *Arenaria tenuifolia* to 300 yards on the non-calcareous slope.

Periodic Phenomena of Vegetation.—A comparison of the times of the various periodical phenomena of vegetation as observed simultaneously in different localities may also be employed usefully in illustration of their climate. The following lists were made in the year 1856, the data for Thirsk resting on my own observation and nearly all of the others having been obtained through the help of kind correspondents resident in the localities to which they refer.

The leaf of the Oak was first noticed on the 18th of May at Mickley and Cowesby, on the 19th at Thirsk, on the 20th at Camphill near Kirklington, on the 22nd at Helmsley, on the 24th at Great Ayton, on the 26th at Husthwaite near Easingwold, on the 28th at Richmond, on the 1st of June at Cotherstone and at Eastholme near Aysgarth, and on the 2nd at Lythe near Whitby.

The leaf of the Ash was first noticed on the 21st of May at Thirsk, on the 25th at Great Ayton, on the 26th at Eastholme, on the 28th at Mickley, on the 30th at Camphill, on the 1st of June at Cowesby and Helmsley, on the 3rd at Cotherstone and Thoralby near Aysgarth, on the 7th at Richmond and Lythe, and on the 8th at Aysgarth.

The first crop of Hay was cut on the 25th of June at Aske near Richmond, on the 27th at Acomb, on the 28th at Husthwaite, and on the 1st of July at Thirsk, Camphill, Great

Ayton and Helmsley, on the 4th at Mickley, on the 7th at Cowesby, on the 17th at Lythe and on the 18th on the Hambleton plateau near Cold Kirby.

The first Harvest crop was cut on August 12th at Raskelf and Thirsk, on the 13th at Catterick Bridge near Richmond, on the 16th at Camphill, on the 20th at Mickley and Husthwaite, on the 23rd at Great Ayton and Helmsley, on the 30th at Cowesby, on the 1st of September at Lythe and on the 2nd on the Hambleton plateau near Cold Kirby. This will give us as the average of the nine principal localities behind Thirsk in round numbers.

Camphill	3 days
Mickley	4 „
Husthwaite	5 „
Great Ayton	6 „
Richmond	7 „
Helmsley	9 „
Cowesby	9 „
Lythe	15 „
Cold Kirby	20 „

So much depends upon difference of soil and exposition, and in the case of the cultivated crops upon the time of sowing the seed, the sort of seed, the state of the cultivation of the land and the state of the weather at the time the crops have to be secured, that results obtained in this way can only be taken as broad approximations. Nevertheless it would seem likely that none of the figures given above are far from being a correct representation of the postponement of the time as compared with Thirsk when the hay crop and harvest are ready in an ordinary season. The part of our field of study where they are ready first seems to be what we may call the *Veronica triphyllos* tract, a surface of light sandy ground which is situated on the Acomb side of York and has something of a southern slope. Between York and Thirsk the average difference is not material; the gardeners say that at Thirsk vegetation is somewhat more liable to be

harmed by spring frosts, but that they can usually compete in the York market with the early culinary vegetables grown in the open air with the neighbourhood of York but not with Doncaster and Pontefract. Between these as grown at Thirsk and in the garden at 300 yards upon the Hambleton plateau there is a difference of about a month. Lythe, though near the sea-coast, is in an exposed position and the soil is argillaceous. Hovingham, with an argillaceous soil and situated upon the slope towards the north of the calcareous Howardian terrace is ten days later than Thirsk. Between the light sandy soils over the New Red Sandstone on the west of Thirsk, and the clayey soils of the undulated liassic tract on the east of the town there is a difference of a week or ten days in favour of the former, and as we approach the foot of the hills, where the soil is still clayey, of a fortnight or three weeks. A month appears to be about a fair average of the difference between the earliest crops over a considerable tract of the Central valley and an elevation of 300 yards amongst the hills on both sides of it, that is to say an average of ten days per hundred yards. It is not unfrequent for the wandering labourers who come to Thirsk to be engaged for one month for the harvest in the low country, and when that is finished to get employment for another month upon the top of the Hambleton plateau. Especially in the west the ingathering of the crops in the hilly district is much more liable to be retarded by rain than in the low country. In the early part of the year there appears to be a retardation of from six weeks to two months in the flowering of species upon the Mickle Fell ridge as compared with the Central valley, and the retardation of the hay and harvest crops in the Central valley as compared with the South of England is about three weeks.

Temperature of Springs and of the Sea.—In our climate it would seem that at a depth of three feet in the ground the annual range of temperature sinks to from 15 to 20 degrees, the periods of maxima and minima not differing greatly from what they are at the surface; that at six feet there is a range of

from 10 to 15 degrees and that the times of the maxima and minima are retarded: that at 24 feet below the surface the range is not more than 3½, the periods of maxima and minima being as compared with the surface nearly reversed: and that at from 50 to 100 feet below the surface the temperature scarcely varies. According to the observations of Mr. Abbey at Horton Hall near Bradford in 1860 the temperature of the ground at one foot below the surface was upon the mean of the year one degree and a half above that of the air in the shade at four feet from the ground, the difference between the means of the extreme months being less in the ground than in the air by 5·8, and the extremes of cold and heat being both cut off. The ground was lower than the air in March, May, June and July, higher during the rest of the year. Some of the deepest springs which we have in North Yorkshire do not appear to vary at all. The Cayton Bay spring, which supplies Scarborough with water and which issues from the calcareous Oolitic cliffs at a height of 75 feet above high-water mark is stated by Dr. Cooke to be always at 49 degrees. A copious spring between Scawton and Rievaulx, the waters of which, like those of the other, sink through the calcareous beds of the Middle Oolite to gush out at the surface of the Oxford Clay, I have tested at various times both in Summer and Winter and always found it to be about 48 degrees. A third spring, situated under similar geological circumstances in a deep shaded ravine immediately beneath the village of Scawton I have found at 48 both in Spring and Summer. But probably these invariable or nearly invariable springs are confined to the limestone. Of those which vary February appears to be the month of the minimum, and either August or September that of the maximum temperature, the difference between the two varying mainly according to the depth below the surface from which the water comes. At Gormire a spring gushing out of a steep bank composed of the arenaceous rocks of the Lower Oolite with an eastern exposure and situated at an elevation of about 150 yards above the sea-level was tested month by month

during the first half of 1857 and found to be 44, 43, 43½, 43½, 48 and 53½. The following table gives the march from February to September of three comparatively shallow springs situated at an elevation above the sea-level of about 50 yards, which issue from clayey diluvium over lias on the east bank of Cod Beck between the Locks Bridge and the World's End Bridge near Thirsk, the range of variation here being probably an extreme one.

TEMPERATURE OF THREE SPRINGS NEAR THIRSK IN 1857.

	NO. 1.	NO. 2.	NO. 3.	MEAN.
February	42·0	42·0	42·0	42·0
March	43·0	43·5	43·5	43·3
April	46·0	46·0	46·0	46·0
May	47·0	47·5	47·5	47·3
June	52·0	56·0	53·0	53·7
July	54·0	57·0	55·0	55·3
August	56·0	58·0	57·0	57·0
September ...	56·0	58·0	58·0	57·3

The following table of the temperatures of the sea is furnished by Dr. Cooke from observations made at Scarborough during the latter part of 1853 and the early months of 1854.

TEMPERATURE OF THE SEA AT SCARBOROUGH, 1853—4.

MONTHS.	Number of observations.	Mean Temperature of the air.	Mean Temperature of the sea.	Difference.
January	25	37·8	40·5	2·7
February	25	39·2	41·2	2·0
March	15	45·8	42·8	—3·0
April	4	43·0	42·3	—0·7
May	14	50·0	50·0	0·0
June	11	60·0	53·2	—6·8
July	7	63·0	55·8	—7·2
August	8	64·0	56·7	—7·3
September ...	7	57·0	55·1	—1·9
October	9	53·0	52·0	—1·0
November ...	6	46·0	48·0	2·0
December ...	8	38·0	43·5	5·5

This gives us for the sea an annual mean of 48·4. We see that here the difference between the extreme months is about the same as that of the Thirsk springs and lower than that of the monthly means of the air by about 10 degrees, the extreme cold of the Winter and the extreme heat of the Summer being both cut off, as is the case to a lesser extent with the air at the sea-side as compared with what it is at an inland station. It will be seen that the sea is conspicuously warmer than the air in Winter, conspicuously colder in Summer.

Distribution of Humidity.—The Rainfall.—The following table gives the rainfall, month by month, at Greenwich and at seven stations either actually within the limits of North Yorkshire or not far from its borders.

TABLE OF MONTHLY AND ANNUAL RAINFALL IN INCHES.

Months.	Greenwich, 35 years, Mr. Glaisher.	Ripon, 1845—52, C. C. Oxley.	Scarborough, 1855—60, Dr. Cooke and others.	York, 1840—60, J. Ford.	Richmond, 1840—56, Jas. Ward.	Hewell, 1856—60, J. Dawson.	Settle, 1857—59, J. Tatham.	Alleneads, 1856—60, T. Bewick.
January	1·8	1·30	1·30	1·77	2·79	2·20	4·23	6·00
February ...	1·6	0·87	1·10	1·05	1·66	1·28	3·00	2·32
March	1·5	1·31	1·15	1·27	1·35	1·84	2·77	4·16
April	1·8	1·87	2·20	1·56	1·72	2·82	2·23	3·67
May	2·1	1·68	1·82	1·62	1·79	2·00	2·17	2·37
June	1·9	2·33	1·67	2·37	2·58	3·25	3·63	4·37
July	2·7	1·79	2·34	2·74	3·34	2·80	4·22	2·48
August	2·4	1·88	2·15	2·95	2·83	2·82	3·29	4·12
September...	2·4	1·55	2·32	2·21	2·61	3·27	3·36	5·42
October	2·8	2·68	2·50	2·12	2·94	2·37	4·72	4·33
November...	2·4	1·87	1·35	1·83	2·45	2·80	4·25	3·77
December...	1·9	1·43	1·70	1·22	2·19	2·87	3·72	4·27
Total of the year.....	25·3	20·56	21·60	22·71	28·25	30·32	41·59	47·28

It will be seen that the distribution of the fall over the different seasons of the year is very irregular. Out of the seven northern stations the least rainy month in five cases is February, in one March and in one May; the most rainy in three cases October, in two September, in one July and in one August. At Greenwich the Winter and Spring have about the same amount of

rain ; the Autumn has about half as much more and the Summer a little less than the Autumn. At the Northern stations the Autumn is the most rainy season of the year in four, the Summer in three cases, but in every case Summer and Autumn taken together have more rain than falls during Winter and Spring taken together. The following table gives the number of days during which more or less rain has fallen during the twenty-four hours in four of the stations upon an average of years varying in number from five to twelve.

AVERAGE NUMBER OF RAINY DAYS PER MONTH AND YEAR.

Months.	Scarborough, 1855–60, Dr. Cooke and others.	York, 1849–1860, Jno. Ford.	Bywell, 1856–60, J. Dawson.	Allenheads 1851–60, T. Bewick.
January	11·2	13·8	17·4	25·5
February	8·0	10·2	12·6	20·2
March	8·2	9·8	15·2	22·2
April	9·0	11·9	17·7	23·0
May	7·2	10·6	11·2	19·2
June	8·2	12·2	19·0	21·0
July	9·2	11·5	18·8	22·0
August	8·7	12·6	14·7	19·7
September	8·0	11·8	18·0	22·0
October	13·0	15·9	17·0	23·3
November	8·5	14·6	18·3	20·3
December	11·5	11·5	18·3	23·3
Total of the year	110·4	156·4	198·2	261·7

So that we see that both the smallest quantity of rain falls and upon the fewest days upon the east coast. In the Central vale the rainfall does not differ notably from what is usual in the eastern counties of England apart from the hills. Amongst the eastern moorlands there is doubtless an advance upon this, but to what extent I am unable to say ; and as we leave the low country to penetrate the moorlands of the west both the quantity of rain and the number of days upon which it falls augment conspicuously, and amongst the loftier mountains which lie near

the county boundary the quantity of rain which falls is no doubt considerably higher than is represented by the highest figures which we have given. The rain-clouds which gather round the peaks frequently do not reach the dales and an excursionist from the towns at the head of the western dales often gets thoroughly wetted during a climb amongst the hills and on returning to the starting point finds that little or no rain has fallen there.

The Mean Humidity of the Atmosphere.—By calling in the aid of the wet and dry bulb thermometer we are enabled to obtain a far more precise idea of the real humidity of the atmosphere than we can get by considering the rainfall alone. The following table gives, for four of the stations of which the rainfall has been already stated, the average humidity of the atmosphere month by month, taking saturation at 100, and in a fifth column that of Greenwich is appended.

MEAN HUMIDITY OF THE ATMOSPHERE, TAKING SATURATION AT 100.

Months.	Greenwich. 19 years. J. Glaisher.	Bywell. 1856-60. J. Dawson.	York. 1849-60. J. Ford.	Scarbro'. 1855-60. Dr. Cooke.	Allenheads. 1856-60. T. Bewick.
January	89	87	90	91	90
February	86	87	90	88	94
March	82	84	89	86	90
April	79	83	82	88	86
May	76	80	78	87	82
June	73	82	83	84	85
July	76	73	83	86	76
August	77	78	83	88	80
September	81	82	89	88	88
October	87	85	88	90	90
November	89	83	87	93	90
December	89	86	88	92	89
Mean of the year	82	83	86	88	88

This table shews how little there is of any definite relation between rainfall and mean atmospheric humidity. Scarborough with its 21½ inches of rain is upon a par as regards dampness of air with Allenheads, where the rainfall is more than double. At Greenwich, which is the only station for which the observations extend over a considerable number of years, there is a regular increase in humidity from June to November, a regular decrease from January to June. The difference at Scarborough between the extreme months of the year is only 9, whilst at Greenwich it is 16 and at Allenheads 18. And we see also how humid is even our low country, a circumstance no doubt to be attributed mainly to its nearness to the two ranges of hills, and a peculiarity which must exert an important influence both upon health and vegetation.

Winds.—The following table, after Professor Phillips, gives the average number during each of the four quarters of the year of the different winds as observed at York from 1800 to 1809, the average temperature of each from 120 observations of each during each month of the year at York, at 8 a.m., and the average dampness of each as observed by the oat-beard hygrometer at Brandsby.

COMPARATIVE FREQUENCY AND TEMPERATURE OF THE DIFFERENT WINDS AT YORK AND THEIR HUMIDITY AT BRANDSBY.

WINDS.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
Temperature	45·7	46·2	48·5	47·7	48·4	50·4	49·8	45·4
Humidity	48·5	54·4	52·7	62·7	62·3	54·3	54·4	51·6
Jan.—March	9	9	9	11	12	16	14	10
Apl.—June	9	13	7	8	8	16	17	12
July—Sept.	7	6	6	6	8	24	23	11
Oct.—Dec.	9	7	6	8	10	21	14	13
TOTAL.	34	35	28	33	38	77	68	46

The following list, then, will indicate their order of sequence in respect of frequency, temperature and humidity.

ORDER OF SEQUENCE OF THE DIFFERENT WINDS IN RESPECT OF		
FREQUENCY, beginning with the least frequent.	TEMPERATURE, beginning with the coldest.	HUMIDITY, beginning with the driest.
East.	North-west.	North.
South-east.	North.	North-west.
North.	North-east.	East.
North-east.	South-east.	South-west.
South.	South.	West.
North-west.	East.	North-east.
West.	West.	South.
South-west.	South-west.	South-east.

The principal anomaly or local peculiarity here is the position in the lists as regards temperature of the North-west wind and as regards humidity of the South-west and North-east; and these we must explain by remembering the position of the low country with regard to the hill-masses. The North-west wind is normally warmer than the North-east, but with us it blows from a cold mountainous region and often brings severe weather. The average temperature of the East wind is raised so high by the height which it reaches in Summer, but in Winter it is one of the coldest of the winds. The North-east is usually known as a keen dry wind, but with us it is thrown up by beating against the eastern range of hills, and thus losing heat and density, often discharges its moisture in the shape of sleet; and the normally damp South-west on the contrary has much of its moisture absorbed by the Pennine chain before it reaches us.

The following table gives a list for an upland, a lowland and a maritime station, on an average in some cases of four and other cases of five recent years, of the number of winds during each quarter as arranged under the four principal heads, and of their average force at the different stations during the same period, this last an important datum in connection with climatic influences.

AVERAGE ANNUAL NUMBER OF THE DIFFERENT WINDS AT AN UPLAND, A LOWLAND, AND A MARITIME STATION, AND THEIR RELATIVE FORCE.

	SCARBOROUGH.					BYWELL.					ALLENHEADS.				
	N.	E.	S.	W.	Force.	N.	E.	S.	W.	Force.	N.	E.	S.	W.	Force.
Jan.—March	21	18	29	41	3·0	22	18	19	46	1·5	19	27	36	51	2·0
April—June	33	46	28	28	2·6	21	43	28	32	1·3	18	38	41	38	1·7
July—Sept.	24	22	24	23	2·4	18	22	18	54	1·3	22	20	19	52	1·8
Oct.—Dec.	15	14	25	33	2·5	14	15	23	40	1·2	17	17	24	33	1·5
Total of the Year.	93	100	106	125	2·6	75	98	88	172	1·3	76	102	120	174	1·75

SUMMARY OF RECENT OBSERVATIONS.

I have left almost unaltered this chapter as it stood in the original edition of the work. The following is a summary of the result of the observations of the last twenty years, for which I am indebted to Mr. G. M. Whipple, of the Kew Observatory :—

The Average Temperature of this district, as derived from twenty years' observation (1861-80), is 48·6° Fahr. ; being somewhat lower on the coast than in the interior, the difference between the east and west sides of the county amounting to about 1°. The mean temperature for each month is as follows:

TABLE I.

January.	February.	March.	April.	May.	June.
38·0	40·0	41·0	47·0	52·0	58·0
July.	August.	September.	October.	November.	December.
61·0	60·0	56·0	50·0	42·0	39·0

July is the warmest month, being 61°, and August is 60°. The coldest months are January, 38°, and December, 39°.

The greatest heights the thermometer attained during the period discussed were 87° in 1878 and 83° in 1880. The lowest cold recorded was 0° Fahr. in 1879, and 10° on several subsequent occasions. Table II. shows the extremes observed during the past ten years, and also the mean diurnal range of the thermometer.

TABLE II.

Year.	Highest.	Lowest.	Mean diurnal range.	Year.	Highest.	Lowest.	Mean diurnal range.
1877	78·0	18·0	13·0	1882	75·0	13·0	10·0
1878	87·0	11·0	13·0	1883	74·0	12·0	13·0
1879	77·0	0·0	13·0	1884	82·0	18·0	12·0
1880	83·0	16·0	11·0	1885	82·0	10·0	12·0
1881	81·0	10·0	12·0	1886	81·0	11·0	12·0

The air is fairly dry, the average relative humidity varying between 83 and 87 per cent. of complete saturation.

Bright Sunshine is recorded on the average about 1350 hours in the year, that is, on 29 per cent. of the greatest possible duration, or of the time the sun is above the horizon.

TABLE III.

MEAN MONTHLY SUNSHINE TOTALS AND PERCENTAGES.

Month.	No. of hours of Sunshine.	Percentage.	Month.	No. of hours of Sunshine.	Percentage.
January ...	50	21	July.....	160	32
February...	63	24	August ...	158	35
March.....	128	36	September	103	28
April	120	29	October ...	86	27
May.....	223	45	November	66	27
June	151	30	December	43	19

The most favoured month is May, when 223 hours, or a percentage of 45 of the maximum amount is recorded, whilst the dullest month is December, with but 43 hours, i.e., when less than one-fifth of the time the sun is above the horizon is sunny.

The Average Amount of Cloud is pretty constant, being about six-tenths from year to year, but of completely cloudy days there are 121 annually, averaging one day in three, whilst the clear days average rather less than three in a month all the year round.

Rain.—This varies very much, both in distribution and in amount, being large in the high land on the west and less in the east bordering on the coast. The following table shows the average monthly falls, derived from a long series of observations, collected by the Meteorological Office observers distributed over the Riding.

TABLE IV.

MEAN MONTHLY RAINFALL (IN INCHES) IN THE NORTH RIDING OF YORKSHIRE.

January.	February.	March.	April.	May.	June.
2·09	1·73	1·74	1·85	1·88	2·21
July.	**August.**	**September.**	**October.**	**November.**	**December.**
2·63	2·58	2·93	2·65	2·69	2·89

Mean Yearly Rainfall ..... 27·87 Inches.

During the period, 1872 was the year of heaviest falls, when 40·84 inches fell, whilst the next year (1873) was exceptionally dry, 19·61 inches only being collected.

As examples of the unequal distribution of rain over the district, the returns for 1885 show the following: The greatest fall was at Hawes, where 60 inches were collected on 210 days, whilst at Middlesbrough 20 inches only were measured on 121 days. On the average there are 193 days of rain and 31 days of snow annually, being distributed as follows:—

TABLE V.

MEAN MONTHLY NUMBER OF DAYS OF RAIN AND SNOW.

Month.	Days of Rain.	Days of Snow	Month.	Days of Rain.	Days of Snow.
January	15	6	July	17	0
February ...	17	5	August	14	0
March	14	7	September...	16	0
April	15	1	October	18	1
May	15	1	November ...	19	4
June	15	0	December ...	18	6

Wind.—The winds which blow with the greatest frequency are south-westerly, which are recorded on 75 days in the year, next come the westerly on 61 days and north-westerly on 45 days; easterly winds only occur on 23 days in the year.

Strong winds or gales blow on 14 days per annum, whilst nearly double that number or 27 days are entered as calms. As may be expected, the former are most frequent in February, March, and October, and the latter in September, June, and August.

TABLE VI.

Month.	WIND.—DAYS ON WHICH IT WAS								DAYS OF	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Gales.	Calms.
January	2	1	[illegible]	3	3	[illegible]	6	4	2	2
February ..	1	1	1	3	5	7	5	4	2	1
March	3	3	3	3	3	6	5	4	2	2
April	3	6	4	4	3	4	[illegible]	2	1	[illegible]
May	3	5	[illegible]	3	3	6	5	3	0	2
June	3	4	[illegible]	3	3	6	3	3	0	3
July	2	2	[illegible]	3	3	[illegible]	7	3	0	3
August	3	3	[illegible]	[illegible]	[illegible]	6	5	3	1	3
September..	3	3	1	[illegible]	3	6	5	4	1	3
October	4	3	[illegible]	[illegible]	2	5	5	5	2	2
November..	3	[illegible]	1	2	3	7	5	5	1	2
December ..	3	1	1	1	3	6	8	5	2	2
TOTALS ..	33	34	23	31	36	75	61	45	14	27

Thunderstorms occur on the average about 8 times in the year, and then only during the summer months—principally in July.

Hailstorms number 14, the maximum number taking place in November.

Fogs are registered 48 times annually, chiefly in the winter, when they average 6 per month.

The Barometric Pressure, reduced to sea-level, averages 29·89 inches in the Riding, varying from 29·83 inches in October to 29·95 inches in May and June. The following table shows the mean value for each month in the year.

TABLE VII.

January.	February.	March.	April.	May.	June.
Inches. 29·85	Inches. 29·88	Inches. 29·85	Inches. 29·91	Inches. 29·95	Inches. 29·95
July.	**August.**	**September.**	**October.**	**November.**	**December.**
Inches. 29·91	Inches. 29·89	Inches. 29·87	Inches. 29·83	Inches. 29·86	Inches. 29·88

Sea Temperature.—The average surface temperature of the sea off the coast is 49°, varying from 57° in August to 41° in January and February.

TABLE VIII.

MEAN MONTHLY SEA TEMPERATURE.					
January.	February.	March.	April.	May.	June.
41·0	41·0	44·0	46·0	51·0	55·0
July.	**August.**	**September.**	**October.**	**November.**	**December.**
56·0	57·0	56·0	51·0	47·0	43·0

Trees and Shrubs killed and injured in Severe Winters.—The following data relative to the North Riding are extracted from the Report of the Effect on Trees and Shrubs of the Exceptionally Severe Winters of 1879-80 and 1880-81, recently edited by the Rev. G. Henslow for the Royal Horticultural Society.

In 1879-80 minimum temperatures were registered as follows:

Place.	Altitude above sea-level, in feet.	Minimum temperature.
Bedale	151	—9·0
York	55	—4·5
Beningborough Hall	50	—2·0
Whitwell Hall	280	1·0
Aysgarth	660	2·7
Scarborough	115	19·5

In 1880-81 they were as follows:—

Place.	Altitude above sea-level in feet.	Minimum temperature.
Aysgarth	660	—2·8
Whorlton	142	—1·0
Whitwell Hall	280	1·0
York	55	1·0
East Layton	113	1·0
Scarborough	161	7·7

In 1879-80 the following trees and shrubs were killed and severely injured:

At Hildenley (Sir C. W. Strickland), alt. 250 feet, garden with a southern exposure. Killed—*Berberis Darwinii*, *Cupressus macrocarpa*, *Raphiolepis ovata*. Injured—*Aucuba japonica*, *Euonymus japonicus*, *Hypericum patulum*, *Juglans regia*, Yew, Walnut, *Platanus*, *Dacrydium Franklinii*.

At Bedale, alt. 150 feet, not exposed (Sir H. Beresford-Pierse Bart.). Killed—*Berberis*, Deodar, Portugal Laurel, Cherry Laurel, all standard Roses (in the neighbourhood of Bedale 10,000 roses were killed). Injured—Holly, Yew.

At Beningborough Hall, near York, alt. 50 ft. (Mr. A. Foster). Killed—*Berberis Darwinii*, *Garrya elliptica*, *Laurustinus*, *Rhododendron ponticum*, standard Roses (15,000 dwarfs and standards killed in the neighbourhood of York). Injured—*Arbutus*, *Aucuba*, Holly, Bay, Cherry Laurel, Portugal Laurel.

In 1880-81, at Beningborough Hall. Killed—*Cistus ladaniferus*, *Eriobotrya japonica*, *Lonicera fragrantissima*, *Osmanthus ilicifolius*, hybrid perpetual Roses and standards grafted on briar. Injured—*Cotoneaster microphylla*, *C. Simonsii*, *Cratægus Pyracantha*, *Forsythia*, *Fuchsia Riccartoni*, *Picea Nordmanniana*, *Rhododendron ponticum*, *Wistaria sinensis*.

TOPOGRAPHY

AND

PHYSICAL GEOGRAPHY.

DRAINAGE DISTRICTS AND GEOGRAPHICAL CATEGORIES OF PLANTS.

Drainage Districts.—The nine districts into which North Yorkshire is subdivided in the map (plate 3) which faces page 75, are founded upon the river drainage, and are, with exceedingly trifling exception, separated from one another either by rivers or lines of water-shed, not like wapentakes and parishes, by purely arbitrary and conventional lines of limitation. These drainage districts are mapped out and used to answer a two-fold purpose: in connection with physical geography to help the mind of those who use this volume to dwell with the prominence to which its importance from this point of view entitles it upon the question of how our field of study is made up of river-basins and what is their extent and configuration: and in connection with botany to aid in tracing out and illustrating the topography of its vegetation. It will be observed that, with very little exception, the boundaries of North Yorkshire as a whole are natural boundaries also. In this part of the work it is intended to pass each of these nine drainage districts under review, and to speak, as we do so, of its more prominent natural features and characteristics, mentioning as we pass along the towns and principal villages which each includes, its hills and its glens and its waterfalls, and also the more noteworthy botanical stations and the plants which they produce.

The following table gives an estimate of the area of each of the districts in square miles and classifies them under the vice-counties of the Cybele Britannica to which they belong.

THE DRAINAGE DISTRICTS.

NAME OF THE DISTRICT.	ITS AREA IN SQUARE MILES.
65. North West Yorkshire.	
9 West Tees	190
8 West Swale	370
7* Ure or Yore	260
64. Mid West Yorkshire.	
6 Nidd and Wharfe (Ainsty) ...	84
62. North East Yorkshire.	
5 East Tees	155
4 Esk	235
3 Derwent	515
2 East Swale	170
1 Ouse and Foss	133
Total	2112

Topography of the Plants as illustrative of Facts of Physical Geography.—The following appears to be the most natural classification of the plants of North Yorkshire in respect of their geographical relations.

1. *The Montane Species*, those plants which (see the chapter on Climate) are either absolutely restricted to the hills and slopes, or are much more frequent there than in the valleys.

2. *The Xerophilous Species*, those plants which (see the chapter on Lithology) are absolutely restricted to or which are much the commonest in the dysgeogenous tracts, growing normally either upon calcareous or basaltic rock or dry ground which these immediately underlie, some of them casually also in dry sandy places elsewhere.

3. *The Maritime Species*, those plants which are essentially restricted to the neighbourhood of the sea, and three species are also included here which are normally maritime but which grow also casually in the interior. North Yorkshire is not rich in

* In Suppl. Flo. Yorks. this is given as belonging to Mid West Yorkshire of the Cybele: but I am informed by Mr. Watson that its proper place is as stated above.

characteristically maritime plants. The coast cliffs yield very few and the only tract where they grow in any considerable abundance is the sweep of low marshland which borders the sea in the neighbourhood of Middlesbrough and Coatham.

4. *The Hygrophilous Species* or plants of standing water. These are the lacustral or paludal plants of the low country, none having been included here which ascend into the Middle Zone. Though the total number of species which it includes is not conspicuously small, the North Yorkshire flora cannot be said to have a large infusion of this element, but rather the reverse. Many of the species are restricted to two, three, or four of the drainage districts.

5. *The General Ascending Species*, i.e., those which are ascertained to occur in all the nine drainage districts. As a general rule the plants which range here are both commoner and more abundant where they occur, not only for North Yorkshire as a whole but also for each of the districts taken separately, than are those of any of the other categories.

6. *The Scattered Ascending Species*, those which do not range under any of the preceding categories and which are ascertained to occur in not less than four of the drainage districts. Some of the ericetal and shade-loving plants which are plentiful amongst the hills come in here, and no doubt many species which further observation will shew to be really 'General.'

7. *The Local Ascending Species*, those which do not range under any of the preceding categories and are ascertained to occur only in from one to three of the drainage districts.

The following table shews for North Yorkshire as a whole the absolute number of the Native Flowering Plants and Ferns of each of these categories in its flora and the relative proportion which each bears to the whole flora as tested by the number of species.

GEOGRAPHICAL ANALYSIS OF THE NORTH YORKSHIRE FLORA.
TOTAL AREA OF NORTH YORKSHIRE 2112 SQUARE MILES.

	Number of species.	Per centage of total native flora.
1 Montane Species.....	86	10
2 Xerophilous ,, ...	71	8
3 Maritime ,, ...	53	6
4 Hygrophilous ,, ...	80	9
5 General Ascending Species	362	41
6 Scattered Ascending ,,	166	19
7 Local Ascending ,,	76	8
Total number of native species.	882	

For each of the drainage districts, as we pass them under review, a table similar to the above will be given : and it is very interesting to note the differences in respect of the way in which their floras are made up which the different districts show, and to attempt to trace out how far the difference in the composition of the nine floras runs parallel with the difference in the physical character between the nine districts. Upon comparison of the analytical table which is given for each district with what is stated respecting its physical geography it will be seen that, in point of fact, this parallelism does exist to a remarkable extent. The districts which are comparatively rich in Montane species are those which have the most extensive and highest tracts of hilly ground : the districts which are comparatively rich in Xerophilous species are those which have a continuous extent of dry rock and dry surface soil with tabular hills and steep-banked dales : and the Rarer Ascending species are highest in number in those districts which contain the greatest extent of low-lying level country. And it so happens invariably that when the number of species of any of these geographical categories comparatively predominates in a district, that there most of the species of that category grow in greater abundance than they do in a district in which the number of species is small.

For instance, the number of Montane species which grow in the West Tees district is 77 and in the East Swale district is 23. If the total number of individual wild plants which grow in the two districts could be counted, I have no doubt the squares of 77 and 23, that is to say 5929 against 529, would represent more truly the relative proportion of the two, in respect of the number of individual plants of species of the Montane category which they would be found to yield, than would the unmultiplied figures. In this way it is intended that the analytical tables and lists of rarer plants which are given under each drainage district should be considered as data in illustration of its physical geography. About a dozen species are given both as Montane and Xerophilous, but except these, each is given under a single category only.

THE WEST TEES DISTRICT (No. 9).

This district includes the whole of the Yorkshire portion of Upper Teesdale, so well-known and so deservedly attractive, not to botanists and geologists only, but also to lovers of wild and picturesque scenery. The Tees rises upon the slope of Cross Fell, a mountain which towers upwards near the edge of the great Pennine escarpment to a height of 2900 feet. This is in Cumberland, and the streams which flow from the western slope find their way into the Eden, whilst on the east only a narrow spur of moorland separates the head waters of the Tees from those of the Tyne. At the foot of this hill it is joined by Trout Beck, and for five miles forms the boundary between Westmorland and Durham. During this part of its course it flows towards the south-east, a gradually augmenting slowly declining stream, almost lake-like in its breadth and stillness, with broad undulated tracts of boggy, heathery moorland rising steeply from it on either side. This long lake-like expansion is called the Weel. From the foot of Trout Beck its course is amongst the Lower Mountain Limestone, but not far from the head of the Caldron Snout, at a height above the sea-level of 500 yards, it enters the Basalt.

At the Caldron Snout the scene changes. First the water becomes ruffled, and then with a rush, the noise of which mingles with the whirr of the grouse and the bleating of the mountain sheep far away amidst these lonely hills, the stream breaks a gorge through the main mass of the Basalt, forming in so doing a series of broken rapids, leap after leap in tumultuous succession, the brown stream dashed by the first leap into foaming whiteness and rushing from ledge to ledge down a deep winding rocky channel, till at last it frees itself from the gorge, and spreads out like a ray of light spreads out as it issues from a prism, over a background of sharp-edged broken basaltic

columns. The total depth of the waterfall is two hundred feet, and nowhere else in England have we so deep a fall upon so large a stream. The best point of view for the fall as a whole is the open ground a short distance below it upon the Westmorland side of the Tees: and from the Birkdale sheep-fold the wooden bridge which spans the upper part of the waterfall, firm enough in reality, looks frail and dangerous. Above the fall massive angular reddish-brown basaltic crags rise steeply to a considerable height and on the Durham side of the stream they sweep round the edge of the fell for fully a mile, forming the range of broken and precipitous cliffs which is known by the name of Falcon Clints.

From the foot of the Caldron Snout to the sea the Tees forms the northern boundary of Yorkshire. Its general direction during the earlier part of its course is at first east and afterwards south-east. From the Caldron Snout to the junction of the Tees and Lune the distance is about ten miles, and this is what may be considered as the Upper Teesdale portion of our drainage district. A rocky river channel ten miles in length with its stream declining in level during that distance about 600 feet, and a compact range of hills also gradually sloping towards the east, the summit of the ridge rising to an elevation of from 1000 to 1200 feet above the stream, these are the general physical features which it presents.

The extreme distance between the Tees and the Lune is not more than four miles. The rhomboidal mass of moorland which intervenes between the two streams culminates in a long ridge of limestone with patches of millstone grit over it at both its eastern and western extremities. This is Mickle Fell,* the highest of the Yorkshire summits, and the top of the western patch of gritstone is 2596 feet above the sea-level. The view from the summit on a clear day is very extensive. On the north-west there is a sudden fall in the direction of Maize Beck and across

* The three Craven peaks, Whernside, Ingleborough and Penyghent are better known than Mickle Fell, and are often given as the highest Yorkshire hills. The height of Whernside is 2414 feet, of Ingleborough 2373, and of Penyghent 2273.

a broad hollow may be seen a mass of hills in which the three peaks of Cross Fell, Dun Fell and Scordale Head are conspicuous, and the head of a curious boat-shaped glen called High Cup Nick, and the far off peaks of the Lake country looming dimly on the edge of the horizon. Towards the north is the great Teesdale hollow, with Falcon Clints and the white streak of the Caldron Snout immediately in front, and behind them Widdy Bank and Harwood Fell and the ridge of moorland which separates Teesdale from Weardale, and, lower down the dale, the fir plantations of the High Force and Winch Bridge, with wall-bounded bright green fields and the Duke of Cleveland's white-washed farm-houses. On the east the view stretches over the woods and slopes and lower hills of the country round about Barnard Castle and Richmond, and embraces the whole breadth of the richly-cultivated vale of York, and as far as the Hambleton Hills. And on the south over Lunedale and Balderdale and the Stainmoor depression are the innumerable undulated peaks which cluster round the upper part of Swaledale and Yoredale, and beyond them the more abrupt outlines of Whernside, Ingleborough and Penyghent.

At the eastern extremity of the ridge at the summit of the slope towards Westmorland *Myosotis alpestris* grows. The following are the other more noteworthy plants of the summit ridge, growing most of them in the hollows and crevices in the limestone:

Draba incana
Viola lutea
Arenaria verna
Saxifraga hypnoides
Galium sylvestre
Gentiana verna
Carex rigida
Sesleria cærulea
Allosorus crispus
Asplenium viride

Andreæa alpina
„ *crassinervia*
Andreæa Rothii
„ *petrophila*
Dicranum fuscescens
Distichium capillaceum
Encalypta ciliata
Webera polymorpha
Bryum filiforme
„ *concinnatum*
Zieria julacea
Antitrichia curtipendula
Heterocladium heteropterum
Pseudoleskea catenulata.

From the summit ridge in the direction of Maize Beck the descent is sudden, the distance being about a mile, and the difference in elevation not less than 1200 feet. This slope is crowned by a small scar of Main Limestone, and is intersected by several streamlets, one of which takes its rise at the foot of the scar. The rarer plants of this slope are *Epilobium alsinifolium*, *Sedum villosum*, *Saxifraga stellaris*, *Hirculus* and *aizoides*, *Bryum pallescens*, *Tetraplodon mnioides* and *Hypnum sarmentosum*. The Maize Beck only touches Yorkshire during the lower part of its course, and separates the county from Westmorland. Till it nears the Tees it is a mere moorland stream with a rocky channel, neither so broad nor so deep but that it may be crossed under ordinary circumstances by means of the stones in its bed. During the lower part of its course the channel is deeper and the rocks steeper, and the stream forms a series of small but picturesque rapids as it leaps from ledge to ledge of the Basalt. About these falls the following rarer plants grow :

Trollius europæus begins
Potentilla alpestris
Rubus saxatilis
Galium boreale begins
Hieracium anglicum
Salix phylicifolia begins
Poa Parnellii

———

Andreæa Rothii
Blindia acuta
Grimmia torquata
Rhacomitrium protensum
Amphoridium Mougeotii
Diphyscium foliosum
Webera cruda
Bryum alpinum
,, *concinnatum*
Zieria julacea
Fissidens osmundoides
Pseudoleskea catenulata.

Between the Caldron Snout and the High Force the distance is about five miles. During this part of its course the stream flows in a broad open channel exceedingly full of loose stones and rounded boulders, and nowhere do its immediate banks rise to any considerable height. The average rate at which it here declines in level is about 75 feet per mile. Opposite Falcon Clints the moors of the Yorkshire side are not rocky but slope gradually and come closely up to the river, but soon the stream takes a sweep towards the north, and a broad and open

space is left between the river and the fell, the first farm-house is reached, and green fields begin. This is Upper Cronkley and the hill is called Cronkley Fell.

From the Mickle Fell ridge to the plateau of Cronkley Fell proper the tourist in descending has first to thread his way amongst a perfect labyrinth of peaty gorges, and then several edges of limestone and gritstone, the bands of the lower part of the Yoredale series, are crossed. The Tyne-bottom limestone of the White Force is 1730 feet above the sea-level, the Cronkley plateau rather higher. The fell stands out boldly towards the Tees from the main ridge of hill, so that from the White Force to the Caldron Snout the nearest way is across the back of it, and here we have those undulated patches of loosely granular metamorphosed Tyne-bottom limestone which botanists know so well, patches of white crumbling rock and wiry scraggy turf which easily catch the eye amidst the heather and peat. The following are the rarer plants of the fell-top, growing nearly all of them upon the 'sugar limestone':

Thalictrum alpinum
Draba incana
Helianthemum canum
Hippocrepis comosa
Dryas octopetala
Galium sylvestre
Gnaphalium dioicum
Gentiana verna
Vaccinium Oxycoccus
Bartsia alpina
Primula farinosa begins
Plantago maritima
Juniperus communis
Tofieldia palustris
Juncus triglumis (planted)
Elyna caricina
Carex capillaris
Lycopodium selaginoides

Grimmia Doniana.

The stream which flows from the back of Cronkley Fell is joined by another little streamlet from the east, upon the banks of which, a short distance from their junction, *Polygala austriaca* grows, and at the edge of the fell falls over a deep scar of Tyne-bottom limestone based upon Basalt. This is what is called the White Force. There is a way down from above to the centre of the waterfall, and on the west of it a deep perpendicular precipice, and upon each side the hills sweep round towards the force so as to form a sort of ravine, the lower part of which

is almost blocked up by fallen débris. The following rarer plants grow here :

Geranium lucidum
Galium sylvestre
„ *boreale*
Hieracium anglicum
„ *iricum*
Pyrola secunda
Asplenium viride

Andreæa Rothii
„ *alpina*
Encalypta ciliata
Grimmia funalis
„ *torquata*
Rhacomitrium protensum
Amphoridium Mougeotii
Zieria julacea
Bartramia Œderi
Anœctangium compactum
Orthothecium intricatum
Plagiothecium pulchellum.

The edge of Cronkley Fell for about a mile is girdled by a series of steep basaltic cliffs, which extend from the neighbourhood of the White Force westward to the spur of the hill which is opposite the termination of Falcon Clints. These are called Cronkley Scars. They are from one to two hundred feet in depth, as viewed from a distance the colour of mist or smoke-grey, made up of an infinite number of depressions and projections, and though the greenstone rock is seldom to be seen in masses of any considerable size, yet it is so much broken up and breaks away so easily, as to render it a somewhat dangerous exploit to climb amongst the steeper parts of them. Little streamlets trickle over the cliffs in several places, and the slope at the bottom of the scar is thickly strewn with débris. The following are the rarer plants of these scars, and of the open space beneath them, and the adjacent river bank :

Thalictrum alpinum
Draba incana
Geranium sylvaticum
Potentilla fruticosa
„ *alpestris*
Rubus saxatilis
Epilobium angustifolium
Peplis Portula
Ribes petræum
Sedum purpureum
„ *villosum*
Saxifraga aizoides
„ *stellaris*
„ *hypnoides*
Galium boreale
Hieracium iricum
„ *pallidum*
Solidago Virgaurea
Gentiana verna
Arbutus Uva-ursi
Bartsia alpina
Littorella lacustris

Polygonum viviparum
Salix phylicifolia
Habenaria albida
Elyna caricina
Carex capillaris
Sesleria cærulea
Poa Parnellii
Allosorus crispus
Polypodium calcareum
Asplenium viride
Equisetum variegatum

Andreæa alpina
,, *Rothii*
,, *petrophila*
Gymnostomum rupestre
,, *microstomum*
Blindia acuta
Cynodontium Bruntoni
Dicranum falcatum
,, *fuscescens*
Hedwigia ciliata
Grimmia torquata
Racomitrium protensum
Ulota Drummondii
Amphoridium Mougeotii
Bryum crudum
,, *alpinum*
Zieria julacea
Tetraplodon mnioides
Fissidens osmundoides
Orthothecium intricatum
Hypnum Crista-castrensis
,, *exannulatum*
Plagiothecium pulchellum.

Opposite Cronkley the Tees receives a considerable stream from the north, which is called Langdon Beck. Immediately below the mouth of this is the bridge by which access is obtained to the Yorkshire side of the river from the high road between Middleton and Alston. When the stream is low it is just possible to wade across it in this part, but under ordinary circumstances the attempt is not to be recommended. Below the bridge the river again sweeps round to the foot of the Yorkshire fells, and upon the Durham side we have a repetition of Falcon Clints upon a smaller scale in Force Garth Scars. On the south side of the Tees the little stream of Blea Beck forms a narrow steep glen through the Basalt, leaping from ledge to ledge, and overhung with moss-covered rocks, the brown moors sweeping from it on either side. And then comes the High Force. Here the main stream of the Tees, its waters contracted often into a single deep narrow channel, makes a sheer leap of sixty-nine feet into a noble ravine, the cliffs of which margin the stream for a considerable distance below it. The cliff is dark coloured basalt, resting immediately upon dark coloured indurated shale, with limestone below it, and when the stream is full the water flows upon both sides of the massive angular crag

which overlooks the main descent. Here grows *Festuca sylvatica.* On the Durham side of the river the slope is covered by a large plantation, consisting principally of spruce firs, and on the Yorkshire side the moors reach down to the edge of the cliffs. A more beautiful spot for a summer day's excursion than this ravine, with its never-ending roar of waters, in front the cataract with its ceaseless rush and cloud of misty spray, at the bottom the dark foaming stream flowing rapidly amongst thickly strewn boulders and margined in the open space below the cliffs with a grove of fantastically shaped juniper bushes, shut in above by its wood-covered slope and girdle of dark crags, can scarcely be wished for. By the side of the high road at the top of the wood stands the High Force Inn, with a fine view of the waterfall, over the tree tops, from its upper windows.

Between the High Force and the Lune three streams of considerable size flow into the Tees from the north. The distance between the two points is about six miles and the fall in the stream about forty feet per mile. The river channel is now considerably deeper than it is above the High Force, and especially during the first two miles the stream side is much undulated and its banks are often rocky and precipitous. There is a wooden bridge at Lower Cronkley, where the High Force ravine opens out; and where the cliffs are steepest, about two miles below the High Force, a chain bridge spans the river. This is called Winch Bridge, and in its neighbourhood are a series of fine rapids and upon the Durham side a fir plantation again skirts the river. Opposite Winch Bridge the hills again recede from the river, and from this point to the Lune they run parallel with it at a distance from it of about half-a-mile, leaving an open grassy and somewhat wooded space at the bottom of the dale. Above the village of Holwick the continuation of the Mickle Fell ridge, which here is called Green Fell, still reaches the Upper Zone and below it is the wide grassy plateau of Holwick Fell. From the High Force the smoke-grey basaltic crags range along the edge of the gradually declining fells past

Holwick and Unthank and only terminate a short distance before the Lune is reached. The following, in addition to some of those which have been already mentioned, are the rarer plants of Holwick Scars:

Pyrus Aria
Poa Parnellii
Allosorus crispus

Cynodontium Bruntoni
Dicranum Blyttii
„ *fuscescens*
Grimmia torquata
Diphyscium foliosum
Webera acuminata
Tetraplodon mnioides
Heterocladium heteropterum
Hypnum hamulosum
Neckera pumila.

The following are the rarer plants of the cliffs and fields by the stream-sides and the rocks in the bed of the river from the High Force downward to the Lune, growing all of them in the first two miles and many of them also lower down:

Thalictrum flexuosum
Stellaria nemorum
Potentilla alpestris
„ *fruticosa*
Rubus saxatilis
Rosa Sabini
Epilobium angustifolium
Sedum purpureum
Peucedanum Ostruthium
Galium boreale
Crepis succisæfolia
Hieracium anglicum
„ *iricum*
„ *pallidum*
„ *murorum*
„ *gothicum*
„ *crocatum*
„ *corymbosum*
Serratula tinctoria
Carduus heterophyllus
Bartsia alpina
Melampyrum sylvaticum
Plantago maritima
Polygonum Bistorta
„ *viviparum*
Rumex aquaticus
Salix purpurea
„ *phylicifolia*
Juniperus communis
Habenaria albida
Convallaria majalis
Melica nutans
Poa Parnellii
Asplenium viride
Equisetum umbrosum
„ *variegatum*
Lycopodium selaginoides

Sphagnum rubellum
Gymnostomum rupestre
„ *curvirostrum*
Seligeria Doniana
Blindia acuta
Dicranella rufescens
Dicranum fuscescens
Distichium capillaceum
Encalypta ciliata
Grimmia torquata
Orthotrichum rupestre
Ulota Drummondii
Amphoridium Mougeotii
Diphyscium foliosum

Aulacomnion androgynum	*Fissidens osmundoides*
Webera cruda	*Anœctangium compactum*
Bryum alpinum	*Amblystegium Sprucei*
„ *pallescens*	*Orthothecium intricatum*
Zieria julacea	*Hypnum incurvatum*
Meesia uliginosa	*Plagiothecium pulchellum*
Bartramia Halleriana	*Fontinalis squamosa.*

At the Lune, which at its junction with the Tees is 700 feet above the sea-level, Upper Teesdale may be considered to terminate. Respecting the geology of the tract almost all which is necessary to say is contained in the geological chapter. At the bottom of the upper part of the dale, forming the cliffs of Cronkley, and those over which the river falls at the Caldron Snout, is the great basaltic mass, which extends up Maize Beck for a couple of miles and in an eastern direction occupies the bed of the stream as far as the High Force. A little lower down it leaves the bed of the river and ranges along the southern slope of the dale almost as far as the Lune. The stratification of the sedimentary rocks is much disturbed and complicated by the four faults of which we have spoken and others of lesser importance. From a floor of Basalt rises upwards the Mickle Fell ridge, the Lower Mountain Limestone at the bottom, but the greater part of the slope made up of the Upper Mountain Limestone, which has patches of Millstone Grit over it in two places. From this ridge there are down-throws towards Westmorland and towards the east and lower down the dale a down-throw or steep dip towards the North, so that first the Lower and afterwards the Upper Limestone occupies the river-bed. And then comes the thousand feet fault which runs along the line of Lunedale, beyond which nothing is seen but Millstone Grit till we reach the Greta.

The most noteworthy characteristic which Upper Teesdale presents from a botanical point of view is, that it furnishes several Montane rarities which are separated more or less conspicuously from the other localities in which they occur. Restricting ourselves to the flowering plants of the Yorkshire

side of the river the following are the species which furnish the most striking instances of this exceptionality. *Polygala austriaca*, a species diffused upon the Continent from Scandinavia southwards to Italy and Transylvania, is elsewhere known in Kent and Surrey only in Britain. *Potentilla fruticosa* and *Gentiana verna*, both of which are abundant in Teesdale, and both widely diffused upon the Continent, grow in the West of Ireland and sparingly in the Lake District, but are not known elsewhere in Britain. *Bartsia alpina* grows in Craven and the Lake District, and from thence leaps to the East Highlands. *Elyna caricina* is like the *Bartsia*, except that it is not known in Craven. *Myosotis alpestris* and *Tofieldia palustris* from Teesdale leap to Perthshire; and *Hieracium iricum* and *Carex capillaris* are also known in Craven, but not in the Lake District, and leap from Yorkshire to the hills of Dumfriesshire.

The Lune rises upon the edge of the county and the southern slope of Mickle Fell, and runs due east along the edge of the fault for seven miles. Lunedale at its upper part is a broadly undulated hollow with a good road at the bottom, but with very few houses, and with its slopes on either side but little diversified by cliffs. The streamlet which flows from the east end of the Mickle Fell ridge forms a small waterfall over a gritstone edge and runs through a lonely mountain tarn about half-a-mile in circumference, upon the banks of which grow *Ranunculus cœnosus*, *Allosorus crispus*, *Mnium subglobosum*, *Hypnum stramineum* and *H. exannulatum*. Passing Howgill and the dark Scotch fir plantations of Wemmergill, which latter runs up to the south slope of Green Fell, three miles from the junction of the Lune with the Tees the fault crosses it and continues along the south side of the dale till it opens out into Teesdale. On the Durham side of the Tees opposite Lunedale is Middleton, the mining capital of the dale. South of the fault is a wide surface of moorland country of the eugeogenous type of character. Its two principal dales are Balderdale and Deepdale, both of which have pleasant rocky stream channels and thick woods in their

lower parts, but open out soon after the Middle Zone is reached into broad spreading moorland glens. Kelton Fell, upon the western edge of the county between Lunedale and Balderdale, almost or quite attains the Upper Zone. At the foot of its slope towards the Tees are Mickleton and Romaldkirk, the latter the old centre of population for the upper part of the dale. At the junction of the Black Beck and the Balder is the long-known station for *Saxifraga Hirculus*, and near it Mr. W. Foggitt has lately found *Carex limosa*. Near the junction of the Balder with the Tees is the pleasant straggling village of Cotherstone. The following are the rarer plants of the woods and stream channel of the lower part of Balderdale :

Euonymus europæus	*Atropa Belladonna*
Ribes petræum	*Gagea lutea*
Sedum villosum	
Hieracium murorum	*Orthotrichum rivulare*
Lathræa squamaria	*Rhynchostegium depressum.*

South of the Balder the moorland bears the general name of Stainmoor, and Goldsborough, a broad topped angular peak with edges of Middle Gritstone, which is 1274 feet above the sea-level, is conspicuous. 'Deepdale's solitude'* is broken now by the rush over it, six times a day, of passenger trains, not to speak of goods trains, and volunteer rifle shooting in addition. Deepdale is a deep narrow glen, with waterfalls over gritstone edges in the upper part of it, and thick woods with abundance of the beautiful Silver Fir planted amongst them and a profusion of wild strawberries and brambles. There is a huge erratic boulder of Shap Fell granite in the bed of the stream not far from the Tees which is well worthy of a visit. Nowhere in North Yorkshire have we a more massive edge of gritstone than at Cat Castle, and from an elevated and rocky seat overhung by rowan and birch trees there is a charming view of the fairy-like viaduct, iron girders throughout, and 175 feet from ledge to

* 'In Deepdale's solitude to lie,
Where all is cliff and copse and sky;
To climb Cat Castle's dizzy peak,
Or lone Pendragon's mound to seek.—Scott.

basement, by which the railway spans the glen, and of the undulated country round about Barnard Castle, with a background of Durham hills. The following are the rarer plants which Deepdale furnishes :

Corydalis claviculata
Rubus saxatilis
Ribes petræum
Crepis succisæfolia
Hieracium gothicum
Origanum vulgare
Hordeum sylvaticum
Asplenium viride

Cynodontium Bruntoni
Tetraphis pellucida
Plagiothecium Borrerianum.

This railway, the South Durham and Lancashire line, has a fine viaduct over the Tees upon stone arches, and runs up the Stainmoor slope, past Bowes and over the Pennine ridge at the lowest part of the Stainmoor hollow, which is under 500 yards above the sea-level. Where it crosses the moors there are fine views from it of Mickle Fell and Cross Fell upon the north and of Water Crag and the Arkengarthdale peaks on the south. Scott's oft-quoted lines describe this part of the country as viewed by a sentinel from the turret of the castle at Barnard Castle.

'Far in the chambers of the west,
The gale had sigh'd itself to rest ;
The moon was cloudless now and clear
But pale and soon to disappear ;
The thin grey clouds wax'd dimly light
On Brusleton and Houghton height :
And the rich dale that eastward lay
Waited the wakening touch of day
To give its woods and cultured plain
And towers and spires to light again.
But westward Stainmoor's shapeless swell,
And Lunedale wild and Kelton Fell,
And rock-begirdled Gilmanscar,
And Arkengarth, lay dark afar.
While as a livelier twilight falls,
Emerge proud Barnard's banner'd walls,
High crown'd he sits, in dawning pale,
The sovereign of that lonely vale.

* * * *

What prospects, from his watch-tower high,
Gleam gradual on the warder's eye,
Far sweeping to the east he sees

Down his deep woods the course of Tees,
And tracks his wanderings by the steam
Of summer vapours from the stream.

* * * *

Nor Tees alone, in dawning bright,
Shall rush upon his ravish'd sight,
But many a tributary stream
Each from its own dark dell shall gleam;
Staindrop, who from her sylvan bowers
Salutes proud Raby's battl'd towers,
The rural brook of Egglestone,
And Balder, nam'd from Odin's son,
And Greta, to whose banks ere long
We lead the lovers of the song,
And silver Lune, from Stainmoor wild,
And fairy Thorsgill's murmuring child,
And last and least but loveliest still
Romantic Deepdale's slender rill.'

Next comes Thorsgill, a small wooded glen on the very edge of the gritstone, with the ruins of Egglestone Abbey upon the edge of it very near the junction of the stream with the Tees. Scott's description of this glen and that of the last half mile of the course of the Greta have already been quoted (see page 55). The Greta is the last of the branches of the Tees which have their rise amongst the moorlands. From the lowest point of the Pennine escarpment there is a rise of 700 feet to the summit of drainage on the south, and from the four miles of moorland during which this rise takes place the numerous branches of the stream are supplied. The total length of Gretadale is about fifteen miles and the course of the stream is due east. From Water Crag and Mirk Fell we look northward over a broadly undulated hollow with Kelton Fell and Mickle Fell in the background, so wild and dreary that the passing trains look strangely out of place, and the two 'Spitals' at the upper part of Gretadale shine out like green oases in a desert of brown moor. Below Sleightholme the southern fork of the Greta forms a fine waterfall over the Main Limestone, in the neighbourhood of which grow *Ranunculus cœnosus*, *Draba muralis*, *Sedum villosum*, *Poa nemoralis* and *Gymnostomum rupestre*. Two miles above

Bowes the principal branch of the stream is spanned by a natural arch of Main Limestone which bears the name of God's Bridge, and for some distance below the stream is usually swallowed up, like the Dove and Bran by the Middle Oolite. On the south side of the dale the Main Limestone girdles the edge of a steep moor past Hope and Barningham,* beneath a rounded swell of gritstone which sweeps away from the top of it to the summit of the ridge, till at last, at the junction of the Greta with the Tees at Rokeby, 380 feet above the sea, we have the limestone down again to the level of the river. The finest piece of cliff is at Gilmanscar, opposite Bowes, a station for *Draba incana*, *Saxifraga hypnoides* and *Orthothecium intricatum*. The lowest strata of the dale are those of the bed of the river at Rutherford bridge. Below Brignall and Scargill the stream runs in a deep glen, with flagstone quarries and deep woods. Rokeby, with its rocky river channel and thick woods and limestone scars, with Mortham's Tower and Fitz-Hugh's tomb on the crest of the southern slope, and the charming Dairy Bridge, and the steep sylvan bank of the Tees where it breaks through the limestone immediately beneath the Abbey Bridge, should be visited by all tourists.

---

* 'The scenery whose influence I can trace most definitely throughout his works, varied as they are, is that of Yorkshire: of all his drawings I think that of the Yorkshire series have most heart in them, the most affectionate, simple, unwearied, serious finishing of truth. . . . His first conceptions of mountain scenery seem to have been taken from Yorkshire, and its rounded hills, far winding rivers and broken limestone scars to have formed a type in his mind to which he sought, so far as might be obtained, some correspondent imagery in other landscapes. Hence he almost always preferred to have a precipice *low down* upon the hillside, rather than near the top: liked an extent of rounded slope above and the vertical cliff to water and valley better than the slope at the bottom and the wall at the top, and had his attention early directed to those horizontal, or comparatively horizontal beds of rock which usually form the face of the precipices in the Yorkshire dales, not, as in the Matterhorn, merely indicated by veined colouring on the surface of the smooth cliff, but projecting or mouldering away in definite succession of ledges, cornices and steps. . . . Other artists are led away by foreign sublimities and distant interests, delighting always in that which is most markedly strange and quaintly contrary to the scenery of their own homes. But Turner evidently felt that the claims upon his regard possessed by those places which had first opened to him the joy and the labour of his life could never be superseded. No Alpine cloud could efface, no Italian sunbeam outshine the memory of the pleasant dales and days of Rokeby and Bolton: and many a simple promontory dim with southern olive, many a lone cliff that stooped unnoticed over some alien wave, was recorded by him with a love and delicate care that were the shadows of old thoughts and long-lost delights whose charm yet hung like morning mist above the chanting waves of Wharfe and Greta.'—RUSKIN.

The following are the rarer plants of these stations :

Stellaria nemorum
Astragalus glycyphyllos
Vicia sylvatica
Epilobium angustifolium
Rubus saxatilis
Ribes petræum
Lathræa squamaria
Lamium Galeobdolon
Taxus baccata
Gagea lutea

Distichium capillaceum
Grimmia trichophylla
Ulota Hutchinsiæ
Amphoridium Mougeotii
Bryum obconicum
Mnium cuspidatum
Anomodon longifolius
Amblystegium Sprucei.

From the Greta eastward to the district boundary is a tract of undulated low country, with a good deal of wood and generally a strong clayey soil, which altogether occupies something under a quarter of the whole district. It has no town in it or village of any considerable size and does not anywhere exceed five miles in breadth from north to south. A little stream which rises in the low country not far from the Greta flows due east and enters the Tees at Croft. The limestone sweeps obscurely round the upper part of its hollow and the remainder of the surface is mainly occupied, on the west by the Millstone Grit, and on the east by the New Red Sandstone. At Piercebridge the Magnesian Limestone, which comes out in strong force upon the north of the river, just shews itself in a cliff by the Tees side. Here grow *Anemone Pulsatilla*, *Helleborus viridis*, *Sambucus Ebulus* and *Stachys ambigua*. From Piercebridge to Croft an embankment sweeps along by the river side, sometimes coming up to the water's edge and sometimes retreating from it for a short space, upon which, where it is dry and sandy, grow *Rosa Sabini*, *Scabiosa columbaria*, *Picris hieracioides* and *Origanum vulgare*. At a distance of about a mile from the Tees at Stapleton is situate upon the Durham side of the river the town of Darlington. By the side of the Tees in the Central Valley *Scirpus pauciflorus* and *Stellaria nemorum* occur, and there is abundance of *Myrrhis odorata*, and some of the Montane rarities which grow about the upper part of the river, as for instance *Gentiana verna*, *Galium boreale* and *Plan-*

tago maritima, may occasionally be seen to establish themselves for a while. Halnaby Carr, a small piece of wooded swampy ground about a mile from Croft by the side of the road to Richmond, is a good botanical locality. It yields *Ranunculus Lingua*, *Pyrola rotundifolia*, *Listera cordata*, *Carex teretiuscula*, *C. stricta*, *Eriophorum gracile*, *Hypnum stramineum*, and abundance of *H. Blandovii* and *H. nitens*, and in an adjacent lane is a station for *Juncus diffusus*.

The ascertained flora of this district is decidedly below that of five of the others. Of the Montane species it has 77 out of 85, which is considerably more than any of the others can furnish, but the Montane is the sole category in which it can claim a superiority. Its Xerophilous species are neither so numerous nor so abundant as in the West Swale, Yore, and Derwent districts. Of the Submaritime species it has one only; its Hygrophilous plants are very few in number and rare; and its Rarer Ascending considerably under the average number. The following is an analytical table of its flora:

GEOGRAPHICAL ANALYSIS OF
THE FLORA OF THE WEST TEES DISTRICT.
AREA 190 SQUARE MILES.

	CATEGORY.	Number of Species.	Per Centage of total native flora.
1	Montane Species	77	13
2	Xerophilous ,, ...	35	6
3	Maritime ,, ...	1	—
4	Hygrophilous	15	3
5	General Ascending Species	362	62
6	Scattered Ascending ,,	92	17
7	Local Ascending ,,	6	1
8	Colonists	36	
9	Denizens	18	
	Total number of the species.	642	

TRANSACTIONS OF THE YORKSHIRE NATURALISTS' UNION.
PART 13,
ISSUED TO MEMBERS FOR THE YEAR 1887.

(SECOND EDITION OF)

NORTH YORKSHIRE:

STUDIES OF ITS BOTANY, GEOLOGY, CLIMATE, AND PHYSICAL GEOGRAPHY.

BY

JOHN GILBERT BAKER, F.R.S., F.L.S.,

OF THE ROYAL HERBARIUM, KEW, EX-PRESIDENT AND PERMANENT VICE-PRESIDENT OF THE YORKSHIRE NATURALISTS' UNION.

CONTENTS

OF THIRD INSTALMENT (EIGHT SHEETS).

THE WEST SWALE DISTRICT ...	...	pp. 145—158.
THE YORE DISTRICT ...	...	pp. 159—174.
THE NIDD AND WHARFE DISTRICT ...		pp. 175—178.
THE EAST TEES DISTRICT ...	...	pp. 179—185.
THE ESK DISTRICT ...	...	pp. 186—195.
THE DERWENT DISTRICT ...	...	pp. 196—210.
THE EAST SWALE DISTRICT ...	...	pp. 211—219.
THE OUSE AND FOSS DISTRICT ...		pp. 220—223.
INTRODUCTION TO THE FLORA ..		pp. 227—244.
THE FLORA OF NORTH YORKSHIRE (Clematis to Cerastium)		pp. 247—272.

The next instalment will include a continuation of the Flora.

LEEDS:
PRINTED FOR THE YORKSHIRE NATURALISTS' UNION
BY TAYLOR BROTHERS.

SEPTEMBER 1889.

64.5

Museum of Comparative Zoology
OCT 11 1945
LIBRARY
80464

THE WEST SWALE DISTRICT (No. 8).

The Swale belongs entirely to Yorkshire, its summit of drainage being the county boundary on the west. . The head of the dale is encircled by a crescent of continuously elevated land. The summit pass is 1,700 feet above the sea-level, and the greater part of the ridge for many miles round upon each side of it enters into the Upper Zone. Brownber Edge, at the head of the southern fork of the Greta, is 1,956 feet in height, and Nine Standards Rigg, opposite Kirkby Stephen, 2,153 feet. Crossing the dale, we have on the south of it, Fell End 2,105 feet, High Seat 2,328 feet, and Ladies' Pillar 2,257 feet. These three are in a line running north and south at the west end of Swaledale, and are intersected by numerous glens. On the opposite side they slope suddenly, that portion of the dale of the Eden which lies immediately beneath them not being above 900 feet in elevation. And south-east of these, at the western extremity of the ridge between Swaledale and Wensleydale, towers the huge elephantine bulk of Great Shunnor Fell (2346 feet), the second in elevation of the North Yorkshire summits. These are all cragless, treeless, undulated sweeps of hill, with very little to be seen amongst them to attract botanists* or geologists, their surfaces a monotonous iteration of peat bog, heather and swamp. But from any of the peaks excellent views may be obtained of the wild mountainous country round the sources of the Swale, the Yore, the Eden, and the Rawthey, and in the distance, of the hills of the Lake country and Upper Teesdale.

Below the milestone-like boundary which stands by the side of the road to mark where the Westmorland township of Nateby begins there is a peat bog from which the streams run in opposite directions, in the ditches of which *Ranunculus cœnosus* grows,

* For the Nine Standards Rigg florula of the Upper Zone, see page 63.

and above it the peaks rise with tolerable abruptness to a height of 400 feet above the pass. The stream flowing east soon swells to a considerable size, and in the swampy ground about the first sheep-fold the *Ranunculus* grows in plenty. The glen of the northern fork of the Swale is called Birkdale, of the southern fork, which penetrates the recesses of Great Shunnor Fell, is called Great Sleddale. For the first six miles the course of the stream is almost due east, and between its head and the village of Keld, which is just six miles from the source, it declines in level at the rate of not less than a hundred feet per mile. Opposite the mouth of Little Sleddale Beck is the first farm house, Crook Seat, at an elevation of 500 yards above the sea-level. There is an edge of gritstone upon the crest of the moorland swell above it, and a peaty tarn about half a mile in circumference, which is called Birkdale Tarn and is 1614 feet in elevation. Next we have a branch stream from the north, which is called Whitsundale Beck, and runs down a glen which is of considerable size and contains several farm-houses. This streamlet rises amongst the recesses of Nine Standards Rigg, and has two principal forks with a spur of moorland with a scraggy gritstone edge between them which yields *Allosorus crispus* and *Andreæa rupestris*. At the junction of these two forks is a farmhouse called Raven Seat and here green fields begin. From this point to the Swale the stream runs down a steep glen, well-wooded and often margined with Main Limestone scars, over which fall several streamlets which form cascades in a rainy season. I do not remember to have seen *Epilobium angustifolium* anywhere in greater luxuriance and profusion than it grows here. I have not visited the glen late enough in the season to see the plant in flower, but at this time it must show a profusion of rich colouring. In the neighbourhood of some of the farm-houses which this dale contains *Peucedanum Ostruthium* and *Senecio saracenicus* have become naturalised. The rarer indigenous plants of the woods and rocks of the glen are the following :

Trollius europæus begins
Viola lutea
Rubus saxatilis
Myrrhis odorata begins
Hieracium anglicum
,, *murorum*
,, *cæsium*
,, *gothicum*
,, *crocatum*
,, *corymbosum*
Melica nutans
Poa Balfourii

Gymnostomum rupestre
Blindia acuta
Dicranella rufescens
Ulota Drummondii
Fissidens osmundoides
Plagiothecium pulchellum.

Opposite Keld on the north are two long glens called West and East Stonesdale, with a ridge of moor between them which attains the Upper Zone. West Stonesdale is a heathery open undulated dale, with but little cliff, and near the head of it at a height of 500 yards above the sea-level is the gritstone colliery of Tanhill. It is a singular situation for a colliery, the edge of a high ridge of hill at a distance of five miles from even the nearest village, and round it upon every side the moorland ridges and peaks. The level which is driven into the hill-side is about three-quarters of a mile in length, and the coal is of fair quality. There is a good road from Keld up this dale, which unites with the road which runs between Brough and Reeth at the head of it, and from this colliery the greater part of the coal which is used in the upper extremity of Swaledale is procured. East Stonesdale is a narrower glen, the lower part rocky and sylvan, and a smaller rocky sylvan glen called Hind Hole runs up from the Swale in the direction of Rogan's Seat.

In travelling by the high road between the head of the Swale and Crook Seat a quarry of the Main Limestone is crossed at an elevation of 550 yards above the sea-level, and as we descend the Main Limestone is seen again at 450 yards in the shape of a small crag by the Swale side a little above the point where Sleddale Beck falls into the principal river. In the upper part of the Whitsundale glen it attains about the same altitude. At the smelting mill above Keld (1100 feet) we have it on the south side of the stream depressed, by a fault, beneath the surface, but in the bed of the river the Underset Limestone shows

itself, and above the stream on the north side the Main Limestone forms a fine range of crags, with a wooded slope, which extends continuously from where Whitsundale opens out to the mouth of the West Stonesdale streamlet. After the two Stonesdale streams join the Swale it turns due south for a couple of miles, and, what is a very notable circumstance, the dale divides into two branches, that on the west being the broadest and most open of the two, but the other being the opening which the river takes. Between the two glens a fine mass of hill called Kisdon rises to a height of 1636 feet. This is a hill, not only of much picturesqueness, but of great geological and botanical interest. The village of Keld stands at the foot of its slope towards the north-west and we have here the Main Limestone at an elevation above the sea-level of about 1100 feet, and consequently at the north end of the Kisdon mass the Millstone Grit beds fully 500 feet in thickness. But towards the south the Limestone ascends rapidly. The plateau of the hill is about a couple of miles in length from north to south, and of its southern half the Limestone forms the surface, reaching an elevation of 1550 feet.

As we pass along the Kisdon plateau from north to south the difference in vegetation which is connected with the difference in character of the subjacent rocks is well shewn. The gritstone part of the plateau is overspread almost entirely with peat and *Calluna*, with *Eriophorum* and *Rubus Chamæmorus* scattered amongst it, but this is arrested sharply as soon as the Limestone comes to the surface, and instead of it we have a thin wiry turf in which I noted down the following species as prominent:

Ranunculus acris
„ *bulbosus*
„ *repens*
Helianthemum vulgare
Sagina nodosa
Trifolium pratense
Galium verum
„ *sylvestre*
Bellis perennis
Senecio Jacobæa
Primula vulgaris
Plantago lanceolata
Carex pilulifera
Avena pratensis
Sesleria cærulea
Kœleria cristata
Briza media
Cynosurus cristatus
Festuca ovina.

Below Keld the Swale runs through a narrow rocky ravine before it turns towards the south. Here it forms over the Underset Limestone a waterfall about thirty feet in depth, which is called Kisdon Force. The scars of the Underset Limestone margin the stream both above the fall and below it, often contracting the peat-stained waters between narrow channels of rock. The wooded and scar-girdled hills rise abruptly both upon the north and south of the river to a height of 500 feet above it, the Main Limestone rising steeply along the hill slope as we proceed in an eastern direction from the waterfall. From this ravine the rocky glens of East Stonesdale and Hind Hole both branch out and on the east the ridge of Rogan's Seat rises to a height of 1200 feet above the river. This steep craggy sylvan glen, shut in upon three sides by high mountain walls, showing through its opening on the west the brown moors and the wavy line of the ridge of the crescent peaks, is one of the finest and most interesting portions of the river. The following are the rarer plants of the ravine, and of the stream-side from the smelting mill downwards :

Draba incana
Viola lutea
Arenaria verna
Rubus saxatilis
Rosa spinosissima
Epilobium angustifolium
Ribes petræum
Saxifraga hypnoides
Galium sylvestre
Hieracium anglicum
„ *murorum*
„ *gothicum*
„ *prenanthoides*
„ *crocatum*
Taxus baccata
Juniperus communis
Salix phylicifolia
Sesleria cærulea
Poa nemoralis
Asplenium viride

Gymnostomum curvirostrum
Distichium capillaceum
Amphoridium Mougeotii
Webera cruda
Bryum pallescens
Mnium cuspidatum
Bartramia Œderi
Fissidens osmundoides.

Following the highway from Keld to Muker we have opposite Angram a fine range of rugged and broken Main Limestone precipices girdling the crest of Kisdon, and 70 feet below them a scar of Underset Limestone with a fir plantation upon

its slope, in descending from which towards the little stream which runs down this open undulated hollow, the Middle Limestone is obscurely seen at a depth of 150 feet below the Underset band. Upon these crags there is abundance of *Sesleria* and *Draba incana*, a little Yew and Juniper, of the *Hieracia*, *H. murorum* and *H. gothicum*, and *Asplenium viride* and *Orthothecium intricatum* are also to be met with. At Thwaite we cross the Cliff Gill stream in front of a pretty little waterfall over limestone. This streamlet descends from the Buttertubs Pass, over which, between Great Shunnor Fell and Lovely Seat, runs the road from Upper Swaledale to Hawes. Cliff Gill is an open grassy hollow, with the Main Limestone in it at about the same height as at the south end of Kisdon. Upon the banks of its stream we have *Rubus saxatilis*, *Galium sylvestre*, *Hieracium anglicum*, *Asplenium viride*, *Gymnostomum rupestre*, *Amphoridium Mougeotii* and *Bartramia Œderi*. At Muker this stream joins the Swale, which in the four miles from the smelting mill above Keld has declined from 1100 to 850 feet. Here we have *Orthotrichum tenellum* and *O. stramineum* in hedgerows and in the fields *Carduus heterophyllus* in greater plenty than I have seen it anywhere else. This is the part of Swaledale where the lowest strata are exposed. Both in Kisdon and the opposite fells the Main Limestone attains 1550 feet above the sea-level, the Lower Scar Limestone beds being exposed in the bed of the river 700 feet below the upper surface of the Yoredale series, and consequently this latter 250 feet thinner than it is in the neighbourhood of Hawes.

Eastward we have now on the north between Swaledale, Arkengarthdale, and the Greta watershed a grand sweep of ramified elevated moorland. From the Swale to the summit of drainage on the north the distance is at least five miles. On the edge of Gretadale, Water Crag attains 2176 feet, about 900 feet of which is Millstone Grit. This is the extreme thickness which the gritstone reaches in North Yorkshire, the upper beds being of later date than are to be met with in any other station

amongst the hills. Over the edge of Swaledale opposite Kisdon, Rogan's Seat attains 2204 feet, with an elevated spur of hill stretching out from it towards the south, upon which is a station for *Sphagnum molluscum.* A stream runs down from the peaks towards the south and falls into the Swale at Gunnerside. It has a steep grassy glen, margined by the Main Limestone scars, which yield *Sesleria* and *Galium sylvestre*, and in a streamlet which flows from them *Epilobium alsinifolium* grows. Here are some of the lead works of the Old Gang vein, with, as is usual, abundance of *Arenaria verna.* East of this glen Friarfold Moor attains 1935 feet, and Brownsey Moor, which stands boldly out towards the main dale, 1765 feet. On the east of these there is another glen, which opens out at Healaugh, and beyond it a third ridge, of which the summits are Pinseat on the north-west (1914 feet), and Calvey (1599 feet), in the angle between the Swale and the Arkle.

Between Muker and Reeth the distance is nine miles, the course of the stream being again due east, and its fall comparatively gentle, not above twenty-five feet per mile on the average. The slope of the south of the dale is much less broken than that of the north, the streams being mere rivulets and the summit of drainage nowhere more than two miles from the river. The population of this part of the dale is thin, the dale narrow and grassy, its slopes steep and occasionally covered with wood. Beginning on the west the peaks of the southern ridge are Lovely Seat (2215 feet), Muker Moor (1992 feet), Crackpot Moor (1772 feet), Kendall Bottom (1819 feet), and Grinton Moor (1676 feet). The Upper Limestone forms scars along the edge of the dale in many places. From Muker the Main Limestone rises slightly towards the east, so that at Reeth we have it nearly or quite at the top of the fells on both sides of the river.

From Reeth, Arkengarthdale runs up in a north-western direction and at its head opens out into the great Stainmoor depression between the peaks of Hoove (1816 feet), and Water

Crag (2176 feet). At first it is a broad undulated hollow between high gritstone peaks, the summit pass being about 500 yards in altitude. Upon the branch which runs down the hollow between Mirk Fell and Water Crag there is a small colliery, as there is also upon the nearest fork of the Greta, neither being above a couple of miles distant from the larger excavation at Tanhill. In the two long glens which run down into Arkengarthdale upon the eastern slope of Water Crag we have the Main Limestone at 1360 feet above the sea-level. These are called Great Punchard's Gill and Little Punchard's Gill, and in the latter there is a waterfall and fine wooded ravine in the limestone. South of these is the broad elevated plateau of Pinseat (1914 feet), dotted over with disused lead workings and heaps of gritstone débris, and upon its slope towards the Arkle are some of the best lead works of the district. At the bottom of the dale at 1000 feet below the peak is the Arkengarthdale church and village, and in the angle between the Swale and the Arkle the peak of Calvey stands boldly out towards the streams, with the Main Limestone scars girdling its summit, which is 1599 feet in altitude. For several miles along the eastern side of the lower part of the dale we have a fine range of Main Limestone precipices. They begin at Shaw Beck, up which winds the road between Reeth and Barnard Castle, come out in strong force along the edge of Booze Moor (1712 feet), and, crossing a glen, continue beneath the Hind Rake lead mine (1515 feet), and beneath the Copperthwaite lead mine (1415 feet) as far as Fremington, forming as viewed from Reeth a noble range of crags winding along the crest of the opposite hill. The following are the more interesting plants of these cliffs and the Punchard's Gill ravine:

Thalictrum calcareum
Hutchinsia petræa
Thlaspi occitanum
Draba incana
Viola lutea, var.
Rubus saxatilis
Epilobium alsinifolium
Galium sylvestre
Hieracium murorum
„ *cæsium*
Taxus baccata
Juniperus communis

Epipactis ovalis
Sesleria cærulea
Poa nemoralis
Allosorus crispus
Asplenium viride
Lycopodium selaginoides

Gymnostomum curvirostrum
Seligeria recurvata
Blindia acuta
Dicranum fuscescens
Racomitrium protensum
Ulota Bruchii
Amphoridium Mougeotii
Pogonatum alpinum
Zieria julacea
Mnium affine
Orthothecium intricatum
Eurhynchium pumilum
Plagiothecium pulchellum.

The town of Reeth, the mining capital of Upper Swaledale, stands at the foot of Calvey near the junction of the Arkle with the Swale, at a height of 200 yards above the sea level. Between Reeth and Richmond the distance is nine miles, the fall in the river being about the same as it is between Muker and Reeth. The hills now decline rapidly in altitude, the dale widens, and Grinton, Marrick and Downholme are villages of considerable size. The stream still flows towards the east, but there is a considerable curve towards the north, and on the south the tract which it drains grows gradually wider and wider. At Marske it receives a long much-branched stream from the north-west, the moorlands round which slope from Hoove and Booze Moor to 1058 feet above Marrick, 1088 feet above Marske and 950 feet above Applegarth. On the south along the watershed Bellerby Moor attains 1349 feet and Barden Moor 1034 feet, and along the edge of the dale Lambshaw Rigg 1194 feet and the summit of the Red Scar near Downholme 965 feet. This is a very pleasant and romantic portion of the dale. On the southern slope there are extensive fir plantations above Grinton and Ellerton. The Swale is now a stream of considerable size, and along the edge of the fells on both sides of the river the Upper Limestone forms long winding scars, their slope to the high road and stream often covered with aboriginal woods in which the Yew forms a prominent feature. The following are the rarer plants of the cliffs, woods, and stream-sides of this tract:

Aquilegia vulgaris
Silene maritima
Stellaria nemorum
Tilia grandifolia
Euonymus europæus
Vicia sylvatica
Rubus saxatilis
Pyrus rupicola
Epilobium angustifolium
Ribes petræum
Sedum Telephium
Pastinaca sativa
Galium sylvestre
Dipsacus pilosus
Lathræa squamaria
Salix phylicifolia
Juniperus communis
Epipactis ovalis
Gagea lutea
Convallaria majalis
„ *multiflora*
Milium effusum
Melica nutans
Hordeum sylvaticum
Asplenium viride

Meesia uliginosa
Bartramia ithyphylla
Fissidens pusillus.

The river at Richmond is about 300 feet above the sea-level. The Castle is based upon a limestone hill 450 feet in altitude which stands boldly out against the stream and commands a beautiful view of the rocky woods of the lower part of the dale, the surrounding hills, and the wide sweep of low fertile country which stretches across to Cleveland and the Oolitic moors of the east. South of the river there is now a broad extent of thinly populated undulated moory sylvan country sloping gradually from Barden Moor to the Central valley. Within a mile of the town on the north the race-course is 450 feet above it, and on this side towards the dale of Gilling there is also a gradual slope. The following are the rarer plants of the more immediate neighbourhood of the town:

Trifolium scabrum
„ *striatum*
Tilia grandifolia
Rubus Sprengelii
Rosa Sabini
Epilobium roseum
Ribes petræum
„ *alpinum*
Galium boreale
Lactuca virosa
Hieracium corymbosum
Erigeron acris
Campanula glomerata
Salvia Verbenaca
Calamintha officinalis
Lithospermum officinale
Rumex pratensis
Daphne Mezereum
Salix rubra
„ *nigricans*
„ *phylicifolia*
Neottia Nidus-avis
Habenaria albida
Gagea lutea
Potamogeton lucens
„ *rufescens*

Juncus obtusiflorus
Carex divulsa
Arundo Calamagrostis
Equisetum hyemale
———
Sphærangium muticum
Pleuridium nitidum
Gymnostomum tenue
„ *microstomum*
Mnium cuspidatum
Eurhynchium pumilum
Rhynchostegium tenellum
Hylocomium brevirostrum.

For five miles more the Swale pursues a winding course towards the east. Three miles below Richmond it receives Gilling Beck, from the north-west. The limestone from the neighbourhood of Rokeby sweeps round the head of its dale, and above are gritstone slopes, the gritstone on the east of it attaining an elevation of 686 feet in Gatherley Moor. Here *Ulex Gallii* grows; and the woods of the upper part of the dale yield *Euonymus*, *Ribes alpinum* and *Hieracium corymbosum*; and the low marshy ground about Skeeby *Ranunculus fluitans*, *Epipactis palustris*, *Salix nigricans* and *S. phylicifolia*, *Schœnus nigricans* and *Eriophorum latifolium*. At Catterick Bridge the Magnesian Limestone just shews itself and the remainder of the district is included in the Central Valley.

In the Central Valley the river flows with many windings for twenty miles towards the south-east before it joins the Yore. At Kiplin it receives a little beck from Moulton and Middleton Tyas which rises amongst the limestone. The following rarer plants grow near Catterick Bridge and the lower part of this last-mentioned streamlet:

Helleborus viridis
Turritis glabra
Sisymbrium Sophia
Spiræa Filipendula
Bidens cernua
„ *tripartita*
Atropa Belladonna
Scrophularia vernalis
Limosella aquatica
Teucrium Scordium
Marrubium vulgare
Polygonum minus.

In the Central Valley, here as is usually the case elsewhere, the country is everywhere mapped out into meadows and cultivated fields, and the highest elevations do not exceed 200 or 250 feet. Grimscar Beck on the west is a stream of tolerable size. It flows past the town of Bedale and drains a considerable

extent of the undulated gritstone country which lies to the south of Richmond. Upon the Magnesian Limestone at Thornton Watlass *Actæa spicata* grows. South of Bedale the affluents of the river are small and the tract which it drains upon both sides becomes much narrowed. About Carthorpe, Burneston and Kirklington the soil is sandy and gravelly, containing in the detritus over the New Red Sandstone a large admixture of calcareous material brought from the dale cliffs. The following are the more interesting plants of this neighbourhood:

Turritis glabra
Alyssum calycinum
Arabis hirsuta
Helianthemum vulgare
Viola hirta
Hypericum Androsæmum
Ornithopus perpusillus
Spiræa Filipendula
Sambucus Ebulus
Picris hieracioides
Carduus eriophorus
Silybum Marianum
Erigeron acris
Monotropa Hypopitys
Campanula glomerata
Chlora perfoliata
Orobanche minor
Marrubium vulgare
Lithospermum officinale
Primula farinosa
Rumex Hydrolapathum
Spiranthes autumnalis
Orchis pyramidalis
Ophrys apifera
Iris fœtidissima
Alisma natans
Potamogeton plantagineus
Sparganium minimum
Schœnus nigricans
Carex axillaris
Calamagrostis Epigejos
Phleum præcox
Bromus erectus
Pilularia globulifera.

In ditches about the Swale at Ainderby Steeple grow *Cicuta virosa* and abundance of *Ranunculus Lingua.* In the water meadows of the Wiske, Hygrophilous plants abound, and Newby Wiske Carr, a piece of boggy grassy ground intersected by ditches, like one of the Cambridgeshire or Huntingdonshire fens upon a small scale, is one of the best stations for them which we have in North Yorkshire. The following are the rarer plants of this carr and other places in the neighbourhood of Kirkby Wiske:

Ranunculus Lingua
Nasturtium amphibium
„ *sylvestre*
Sinapis tenuifolia
Cerastium aquaticum
Viola flavicornis
Hypericum Androsæmum
Hippuris vulgaris

Myriophyllum verticillatum
Œnanthe Phellandrium
Torilis infesta
Erigeron acris
Utricularia vulgaris
Samolus Valerandi
Polygonum minus
Rumex Hydrolapathum
Hydrocharis Morsus-ranæ
Sagittaria sagittifolia
Butomus umbellatus
Lemna trisulca
Sparganium minimum
Juncus obtusiflorus

Barbula latifolia
Orthotrichum Sprucei.

Leckby Carr is a boggy moory piece of ground south of the Swale near Topcliffe, which yields the following rarities:

Drosera anglica
Rhamnus Frangula
Utricularia minor
Vaccinium Oxycoccus
Lysimachia thyrsiflora
Scheuchzeria palustris
Rhyncospora alba
Carex limosa
Arundo Calamagrostis

Aulacomnion androgynum.

The following are the other rarer plants of the west side of the Swale in the neighbourhood of Topcliffe and Cundall:

Rubus altheifolius
Œnanthe Lachenalii
Silybum Marianum
Gentiana Pneumonanthe
Marrubium vulgare
Primula farinosa
Calamintha Acinos
Daphne Mezereum
Gagea lutea
Schœnus nigricans
Osmunda regalis

Barbula marginata
„ *latifolia*
Cinclidotus fontinaloides
Orthotrichum Sprucei
Fissidens crassipes
Amblystegium fluviatile
„ *irriguum.*

With the exception of that of the Derwent this is the largest of the nine drainage districts and includes about one-sixth of the total area of North Yorkshire. It embraces a wide variety of situation and only the Derwent district has a larger flora. We do not obtain in Upper Swaledale the abundant and very local Montane plants which give a special interest to the botany of Upper Teesdale, but in respect of plants of the Montane category it is about upon an equality with the Yore district and considerably in advance of the lower hilly districts which lie upon the east of the Central valley; and, except of course the

Maritime, the other categories are well represented. Both for Xerophilous and Hygrophilous plants it is very slightly inferior to any of the other districts.

GEOGRAPHICAL ANALYSIS OF THE FLORA OF THE WEST SWALE DISTRICT. AREA 370 SQUARE MILES.

CATEGORY.	Number of Species.	Per Centage of total native flora.
1 Montane Species	52	8
2 Xerophilous ,, ...	45	6
3 Maritime ,, ...	1	—
4 Hygrophilous	62	9
5 General Ascending Species	362	53
6 Scattered Ascending ,,	152	23
7 Local Ascending ,,	15	2
8 Colonists	64	
9 Denizens	23	
Total number of the species.	766	

THE YORE DISTRICT (No. 7).

The upper part of Wensleydale is very different from that of either Teesdale or Swaledale. In Teesdale there is no high-road on the Yorkshire side of the river westward of Holwick and on the Durham side that which runs between Middleton and Alston leaves the neighbourhood of the Tees not far above the High Force and turns towards the north to cross the summit of drainage. Higher than this there is nothing to be seen during the ten miles which intervene before the low country at the foot of the great Pennine escarpment can be reached but a single farm-house and a nobleman's shooting box, surrounded by crags and streams and the wide waste of trackless moorland, over which Mickle Fell and Cross Fell reign supreme. Swaledale is hemmed in and isolated by its guardian crescent of high undulated peaks and the way out at the dale head is by a lonely little road which winds between them over a steep mountain pass 1700 feet in elevation. But Wensleydale, even at its upper part, is a broad open hollow, with good highways leading out of it in three different directions into Mallerstang, Garsdale, and Ribblesdale, over passes the ascent to which is very gradual and the highest of which does not attain 450 yards above the sea-level.

The Eden for a very short but very interesting portion of its early course is the county boundary. The three streams, Eden, Swale and Yore, all rise within a short distance of one another amongst the group of hills to which the crescent peaks of Swaledale belong. Beneath these on the west is a broad open hollow, with a group of dark rugged hills rising abruptly upon the opposite side of it, of which Wild Boar Fell (2323 feet) is the highest, but none of which belong to the North Riding.

To the north stretches the gradually widening glen of the Eden (Mallerstang), to the south that of the Yore (Wensleydale). The Eden is a mere mountain rivulet till it has descended from the fells into the hollow, and then with an undulated sweep of ordinary grassy heathery moorland all around, it plunges suddenly into what is called Hell Gill, in some respects certainly the most remarkable glen which our field of study has to shew. From the very edge of the water upon both sides limestone precipices, to a height of fifty feet, rise so sheerly and abruptly, that in one place, with the maddened mountain torrent foaming and boiling at a depth of fifty feet beneath their edges, it is easy to leap across from one crag to the other. The length of the ravine is under a quarter of a mile and in it the stream declines rapidly in level. The cliffs are over-grown in many places by mosses and bushes, but the recesses of the glen it is almost impossible to explore without a rope, for its sides are much too steep to be climbed, and there is nothing at the bottom but the mere stream channel, and not very far from its opening there is a pool of dark peat-stained water a couple of yards in depth, into which if a luckless mountain sheep fall, woe betide it. The rarer plants of the glen are *Draba incana*, *Rubus saxatilis*, *Hieracium murorum*, *Galium sylvestre*, *Asplenium viride*, *Gymnostomum rupestre*, and *Bartramia Œderi*.

The Yore runs down into the hollow from the peaks at a very short distance from the Eden and nearly parallel with it. From the Shaw Paddock Inn, which stands by the side of the high road at a distance of not much more than a mile from Hell Gill, it flows for six miles towards the south east; on its banks about Birk-rigg the two rare hawkweeds, *Hieracium prenanthoides* and *H. corymbosum* grow abundantly. Here it increases rapidly and from the moors upon both sides of the hollow little streams join it at very short intervals. On the east we have a long unbroken ridge, called Cotter Fell, which attains 2186 feet at its culminating point. Upon the east side of this

ridge is Cotterdale, a dale with two long branches which stretch up far amongst the moors in the direction of Shunnor Fell. In one of the ravines there is a waterfall, with a curious little cavern—called 'Cotterdale House' on the Geological Survey Map—in the limestone, about which *Epilobium angustifolium*, *Lycopodium Selago*, *Pogonatum alpinum*, and *Plagiothecium pulchellum* grow. There is also a fine sylvan waterfall upon the Cotter not far from its junction with the Yore. And upon the south we have Mossdale, also with waterfalls, where grow *Meconopsis cambrica*, *Saxifraga hypnoides*, *Meum athamanticum*, *Encalypta ciliata*, *Webera cruda* and *Bartramia Œderi*.

By the bridge at Appersett village, about a mile from Hawes, *Ceterach officinarum* used to grow, but within the last few years it has disappeared. Here Widdale Beck from the south-west joins the Yore upon almost equal terms, and from this point downwards it is a considerable stream. Along the west side of Widdale stretches a long high ridge of moorland, bare and grassy and towering upwards with wall-like abruptness, of which the peak attains 2203 feet. The Main Limestone scars which girdle it and the limestone pavement of the hill-top have been mentioned already and will often be referred to, along with the similar pavement of Cam Fell, in speaking of the ascending limits of plants. A rounded mass of hill called Woe Fell (1829 feet) stands at the point of junction of Widdale, Dentdale and Ribblesdale. Widdale has two branches, Widdale proper and Snaizeholme, both bare and grassy and both with steep grassy banks, the monotony of which scars of limestone sometimes pleasantly relieve. The high and wall-like western ridge is fully three miles in length and forms the background of most of the views from the lower part of Wensleydale. In the one wood of any size—Widdale Car plantation—*Trientalis europæa* grows profusely. The following are the other rarer plants of Widdale:

Draba incana
Rubus saxatilis
Ribes petræum
Sedum villosum
Galium sylvestre
Asplenium viride
Lycopodium selaginoides

Ulota Bruchii
Zieria julacea
Mnium affine
„ *subglobosum.*

The little town of Hawes stands at an elevation of from 800 to 900 feet above the sea level, within a mile of the point where Widdale Beck joins the main stream of Yore. Seven dales, on the north Yoredale proper, Cotterdale and Fossdale, on the south Mossdale, Widdale, Gayledale and Semerdale, all open out within three miles of Hawes, radiating from it towards the west, north and south. From Hawes due east to Leyburn extends the main Wensleydale hollow, seventeen miles in length, a noble dale, broad and steep, the stream at the upper part at least 1400 feet below the hill-tops, the sides of the dale girdled by long lines of limestone scar, with little villages at the bottom succeeding each other at short intervals, surrounded by pastures and rich luxuriant meadows.

The north side of the dale is much more continuous and less broken than the south, its streams being shorter and its branch dales narrower and less deeply excavated. Next to Cotterdale comes Fossdale. Its two branches extend for a considerable distance into the moors, and then the two becks unite to form a stream which from their junction falls rapidly amongst thick woods, and at last not far from the Yore throws itself over a precipice 99 feet in depth, and forms that gem of the Yoredale waterfalls, Hardraw Force. The cap rock of the fall is the Hardraw Limestone, which also forms scars round the edge of the glen which leads up to it, and this is based upon shale, the limestone projecting so much beyond the shale that it is often quite practicable to pass between the spout of water and the bottom of the rock, though it is at the risk of being drenched by the cloud of spray which surrounds it. The following are the rarer plants of the cliffs and woods of Fossdale and of this Hardraw ravine:

Aquilegia vulgaris
Hutchinsia petræa
Draba incana
Stellaria nemorum
Rubus saxatilis
Rosa involuta
Ribes alpinum
Hieracium murorum
„ *crocatum*
„ *corymbosum*
Salix nigricans
Ophrys muscifera
Habenaria albida
Poa nemoralis
Asplenium viride

——

Gymnostomum rupestre
„ *curvirostrum*
Amphoridium Mougeotii
Orthothecium intricatum
Brachythecium glareosum.

The top of Fossdale is coincident with the head of Cliff Gill which falls into the Swale from the south-west at Muker. Along the edge of the two glens runs the road which leads across the moors from Muker to Hawes. The pass is called the Buttertubs Pass and is 1760 feet above the level of the sea. On the moors bordering the pass *Listera cordata* grows, and the Parsley Fern occurs distributed among the grit tumble on the hill-top. On the west of it rises the huge bulk of Shunnor Fell, and on the opposite side Lovely Seat stands boldly out against it, the summit of the hill being fully 500 feet above the highest point of the pass. This last is perhaps the most conveniently situated of all the hills of the district for giving a panoramic view of the upper part of the Swaledale and Yoredale hollows and it commands also a sight of the peaks of Whernside and Ingleborough.

From the Lovely Seat peak eastward along the watershed the ridge reaches the Upper Zone for at least a mile, and on the edge of Yoredale, immediately over Sedbusk, Stag's Fell attains 1756 feet. The next glen is called Skellgill and is a narrow, uninhabited, somewhat rocky gill which runs from north-west to south-east and yields *Ranunculus Lenormandi*, *Ribes petræum*, *Bryum alpinum* and *Antitrichia curtipendula*. At the little town of Askrigg a very interesting glen, also from the north-west, pours its waters into the Yore. This is called Whitfield Gill and lower down Mill Gill, and contains four waterfalls of great beauty, two of which are of considerable depth. Its two branches run at first for about a couple of miles in undulated moorland

hollows and then they unite. Immediately beneath the peak of Whitfell (1691 feet), with its limestone precipices, and perhaps the most elevated natural wood of any considerable size which we have anywhere in North Yorkshire, wherein *Rhamnus catharticus* ascends to 1200 feet, its highest limit, the stream begins rapidly to descend and soon the first force is reached, consisting of a series of rapids of which the principal fall is not above twenty feet in depth. The next waterfall, Whitfield Force, is much broader and deeper, and the rocky river banks, covered and surrounded by dense woods, rise steeply from it on both sides. The two other waterfalls are only a very short distance from the town, Millgill Force, the finest of the two, being a noble fall over a limestone precipice 69 feet in depth, which is approached by a wooded and rocky glen. The following are the rarer plants of this gill :

Actæa spicata
Stellaria nemorum
Vicia sylvatica
Saxifraga aizoides
Hieracium crocatum
,, *prenanthoides*
Pyrola minor
Lathræa squamaria
Melampyrum sylvaticum
Polygonum viviparum
Habenaria albida

Ulota Drummondii.

From Askrigg to Carperby the hills stand boldly out towards the stream. There is along their edge an almost continuous line of the scars of the Upper Limestone, on most of which *Orobanche rubra* grows, with *Asplenium Adiantum-nigrum* and *Polypodium calcareum* amongst the grit or limestone débris, and the high-road for a considerable distance runs along the summit of a wooded scar of Lower Limestone not far from the water's edge. Near Woodhall are extensive lead mines now unused. The small stream Ellerbeck springs from the hills above here and runs down past the mines to the Yore, joining it near the Aysgarth Ford. At the Askrigg end of the wooded bank, it falls over a ledge of limestone forming a pretty little waterfall. All along this stream down to its junction with the

Yore *Armeria maritima* grows in abundance, and also on the plain immediately below the bold scar of Upper Limestone in Oxclose. The elevation of the highest point where it here grows scarcely exceeds 250 yards. I have not seen the plant elsewhere in an inland station except at a much greater altitude amongst the mountains, as for instance at the head of the Whey Sike in Teesdale and upon the crags of Twll Du and Crib-y-ddysgyl in Snowdonia, but here it is to be met with in the greatest luxuriance and profusion. *Thlaspi occitanum* grows along with it in abundance, but is chiefly confined to the more elevated parts of the stream. *Ophrys muscifera* grows in the woods here. By Locker Tarn above Carperby *Galium uliginosum* grows. Past Carperby the dale widens and the hills decline in altitude. At Bolton the ruins of the old castle occupy a prominent position upon the hill-slope. Near the end of the village is a rocky and wooded ravine, which extends about a mile up the hill in the direction of Swaledale. The stream flowing through the glen has its origin high up on the moors and becomes quite considerable at the village of Redmire, which lies in the hollow below Bolton. *Epipactis latifolia* and *Pyrola minor* grow here. Then comes Preston with its scar and lead-mines, with abundance of *Arenaria verna* and *Viola lutea*; and beneath it, at the bottom of the hollow, stands Bolton Hall, surrounded with woods, and near it the little village of Wensley, which gives its name to the dale.

From the edge of the moor above Wensley runs a long continuous gradually-declining scar of Main Limestone which is called Leyburn Shawl. The hill-slope below the cliff is covered with a dense wood. In proceeding along the walks which extend for a mile along the summit of the scar, a magnificent view is obtained of the great Wensleydale hollow, and of Penhill and the branching sylvan dales which run up behind it and past it on the south; and above the scar upwards to the watershed ridge, stretch the Millstone Grit beds of the hill summits, with extensive flagstone workings excavated amongst

them. The following plants grow either upon or near the Shawl or amongst the débris of the quarries :

Helleborus viridis
Teesdalia nudicaulis
Arenaria tenuifolia
Sagina ciliata
Linum perenne
Euonymus europæus
Trifolium striatum
Vicia sylvatica
Galium sylvestre
Sambucus Ebulus
Hieracium cæsium
Orobanche rubra
Gagea lutea
Festuca pseudo-myurus.

We must now return to Hawes and take the south side of the dale. In this direction, as stated before, the branch dales are broader, deeper and altogether more important than those of the north side of the river. In the spinney just below Hawes the Reed Grass (*Calamagrostis epigejos*) grows abundantly, in its highest Yorkshire station. Along the line of watershed on the south the ridge of hill which separates Yoredale from Wharfedale scarcely declines anywhere from the head of Widdale eastward to the peak of Great Whernside, a distance of at least ten miles in a straight line, below the limit of the Upper Zone and along the whole length of this ridge the Main Limestone reaches a height of 600 or 650 yards.

The ridge which bounds Widdale on the east culminates in the peak of Dodd Fell, 2189 feet in height, with a cap of grit-stone nearly 300 feet in thickness over the Main Limestone. Amongst the heather here at over 2000 feet, *Melampyrum montanum* grows with *Rubus Chamæmorus* in plenty. In the swallow holes of Ten End—the northern extremity—*Epilobium angustifolium* flourishes profusely with *Distichium capillaceum* and *Encalypta ciliata* on the low scars. The slope of this hill is very little diversified by rock, and the ascent is easy and the view from the summit very fine. On the north is Hawes and the broad branching Wensleydale hollow, with Lovely Seat and the woods of Hardraw in the background. East and west, immediately beneath the ridge, their streams 1000 feet below it, are Widdale and Gayledale. Dodd Fell forms one corner of a square of which Whernside, Ingleborough and Penyghent are the other

three, and towards the south we have Cam Fell with its limestone pavement, wild and dreary Langstrothdale and the upper waters of the Wharfe, and farther towards the south and west is outspread a wide surface of moorland country in which the three peaks which have just been named are the most conspicuous objects. The Gayledale stream runs through Hawes and has a fine waterfall upon it two miles from the Yore, a broad spreading fall from thirty to forty feet in depth over limestone based upon shale, with steep wooded shaly banks upon both sides of the stream for some distance below it. The more interesting plants of Gayledale from Dodd Fell summit to Gayle Force are:

Stellaria nemorum
Rubus saxatilis
Ribes alpinum
Saxifraga granulata
,, *hypnoides*
Sedum villosum
Hieracium crocatum
Hieracium amplexicaule *
Salix phylicifolia
Habenaria albida
Polypodium calcareum

Polytrichum gracile
Blindia acuta.

The next ridge has the gritstone over the Mountain Limestone in one place only, and that is within two miles of Hawes, on the peak of Weather Fell, or, as it is sometimes called, Bear's Head, 2015 feet in altitude. Semerdale is unique amongst the North Yorkshire dales in its shape and character. The hills that on each side guard its entrance stand boldly out towards the Yore, especially Addlebrough, at the termination of the boundary ridge on the east, a square-topped hill 1564 feet in altitude, which is crested on its north-western side by crags of the Underset Limestone and forms a conspicuous object from the lower part of Wensleydale. *Allium vineale* grows on the rocks at the summit, and in the hollow at the foot of the hill on the north side, is some dangerous marshy ground, in the stagnant pools of which *Utricularia minor* grows. The elevation of this station is about 1300 feet. At the bottom of Semerdale stands the village of Bainbridge and its stream is sometimes called the Bain; on the wet stony banks above the

village grow *Equisetum variegatum* and *Blysmus compressus.* Two miles from the Yore is a lake measuring between two and three miles in circuit, which is called Semer Water, and which is the only lake of even a moderate size of which North Yorkshire can boast. Bare, steep, grassy hills rise with much abruptness from its eastern and western shores, and beyond the lake there is a little village with a rustic church, and broad branching glens with woods and scattered farm-houses, and numerous gills which penetrate into the recesses of a long steep limestone ridge which runs like a wall along the line of watershed on the south. The rarer plants of the lake-side and surrounding crags and gills are :

Hutchinsia petræa
Draba incana
Potentilla verna
Hippuris vulgaris
Sedum villosum
Peucedanum Ostruthium
Crepis succisæfolia
Lathræa squamaria
Plantago maritima
Alisma natans
Polygonum viviparum
Juncus diffusus
Scirpus acicularis
Sesleria cærulea
Lycopodium selaginoides

Encalypta ciliata
Webera elongata
Zieria julacea
Hypnum lycopodioides.

From Hawes past Bainbridge and Askrigg the fall of the main stream of the Yore is very gradual, when the elevation above the sea-level of its bed is considered. The Juniper grows on the Yore bank near Askrigg station, one of its few stations in Wensleydale. At Aysgarth, in a deeply excavated rocky channel with a wooded bank rising steeply from it upon either side, it begins to form a series of picturesque rapids which are continued for about a mile. Fed by the waters of the wide-branching dales which one after another have poured their contributions into it, the stream is now a fine river. Margined by the long winding scars of the Lower Mountain Limestone and interpolated plate beds it flows down this pleasant Aysgarth glen, its dark peat-stained waters hemmed in upon both sides by shelving reaches of moss-fringed grey limestone rock, and above them there rises a steep bank

covered thickly with aboriginal trees and brush-wood, hazel, whitethorn, brambles, and roses of multiform specific types, and on the south are the broad heathery slopes of Penhill, its peak 1200 feet above the stream. The main fall, which is over a limestone precipice about 20 feet in depth, is exceedingly fine in the impression of irresistible force which it gives when the river is swollen as full as it was the last time that I visited the spot. The following are the rarer plants of the glen :

Aquilegia vulgaris
Euonymus europæus
Hippocrepis comosa
Rubus saxatilis
Rosa micrantha
Galium sylvestre
Hieracium murorum
,, *cæsium*
,, *tridentatum*
Lithospermum officinale
Lysimachia vulgaris
Polygonum viviparum
Daphne Mezereum
Ophrys apifera
,, *muscifera*
Allium Scorodoprasum
Eriophorum latifolium
Sesleria cærulea
Melica nutans
Lycopodium selaginoides
Equisetum variegatum

Distichium capillaceum
Amblystegium fluviatile.

The next three dales, Bishopdale, Waldendale and Coverdale, are very similar to one another in character. They are long narrow dales, with a considerable quantity of wood in their lower parts, their sides steep and grassy and often crested or girdled by limestone cliffs, and they are each terminated by a steep narrow neck of land on the line of the watershed ridge. Southward from Addlebrough along the ridge between Semerdale and Bishopdale a broad surface of moorland culminates in Stake Fell (1843 feet). Opposite the head of Bishopdale and Waldendale and immediately upon the edge of Wharfedale, Buckden Pike attains 2302 feet, and the ridge which runs from it as a spur towards the north-east and separates the two last-mentioned dales from one another attains 1876 feet in Wasset Fell. This Wasset Fell spur ceases at a considerable distance from the Yore, leaving a broad open well-wooded hollow in which are the villages of Thoralby and West Burton, and the two streams unite a mile above where they join the main river

The rarer plants of the woods and crags and fields of these dales are:

Draba incana
Potentilla alpestris
Agrimonia odorata
Peucedanum Ostruthium
Galium sylvestre
Hieracium cæsium
Atropa Belladonna
Mentha sylvestris
Habenaria albida
Ophrys apifera
Ophrys muscifera
Allium Scorodoprasum
Eriophorum latifolium
Sesleria cærulea
Polypodium calcareum
Allosorus crispus
Asplenium viride

——

Encalypta ciliata
Zieria julacea.

Pursuing our course still further towards the east we come next to the ridge which separates Waldendale from Coverdale. It runs from Buckden Pike towards the north-east and terminates in Penhill (1817 feet), a fine broad massive heathery fell which stands boldly out into the main dale of Yore and forms a very conspicuous object in the view from Leyburn and the Vale of Mowbray. Coverdale is twelve miles in length, its upper part being guarded by high hills upon both sides. Opposite Buckden Pike there is Great Whernside* (2310 feet), an undulated grassy hill which commands beautiful views down Wharfedale and Nidderdale and over the lower summits to the east of it and across the Vale of York. This peak is the termination on the east of the long ridge of high moor that runs along the line of watershed between the Yore and Wharfe and upon its eastward slope the Nidd has its course; and looking from Thirsk westward it is the highest point upon the line of the horizon. From Great Whernside and Little Whernside (1985 feet) the peaks decline gradually along the ridge towards the north-east, Rover Crag, which guards the entrance to the dale opposite Penhill, being 1552 feet in elevation. The ground about the lower part of the course of the Cover is open and well wooded. The town and massive old castle at Middleham stand upon the slope of a spur of Penhill not far from the

* This must not be confounded with the better-known and higher Craven Whernside, which is due north of Ingleborough and south-west of Hawes.

junction of the Cover with the Yore. The following are the rarer plants of the dale:

Astragalus glycyphyllos
Epilobium angustifolium
Sedum villosum
Cotyledon Umbilicus
Galium sylvestre
Salix phylicifolia
Ophrys muscifera
Allium Scorodoprasum
Allosorus crispus
Asplenium viride
Lycopodium selaginoides

Andreæa Rothii
Dicranum fuscescens
Oligotrichum hercynicum
Ulota Drummondii
Tetrodontium Brownianum
Zieria julacea
Bartramia Œderi
Orthothecium intricatum.

As we have now reached the point at which Wensleydale is usually considered to terminate, a brief general sketch of its geology may suitably be here introduced. From Hawes eastward as far as Redmire we have the Lower Mountain Limestone occupying the bottom of the dale, rather more than 200 feet of its upper beds being altogether exposed. Over these are the strata of the Yoredale series, at the upper part of the dale 970 feet in thickness, five thick bands of limestone with still thicker interpolations of non-calcareous material, the strata answering to each other upon the slope of the opposite hills from south to north with but trifling difference in level. Along the ridge of watershed from the head of Widdale eastward to the head of Bishopdale the surface of the Upper or Main band of the Yoredale limestones attains an elevation of from 1900 to 1950 feet. Between the head of Bishopdale and the Wharfedale side of Great Whernside the summit of the series sinks to 1700 feet, and its thickness becomes very much diminished, principally by the obliteration of its upper beds. In the immediate neighbourhood of Hawes we have the Main Limestone at an elevation of about 1800 feet on the south side and of about 1700 feet on the north side of the dale; and as we go down the dale it declines gradually in level. It reaches 1100 feet on the east side of Penhill, 850 feet in Middleham Moor, 700 feet at Leyburn, and sinks to 400 feet at East Witton. And above the strata of these two sets of Mountain Limestone beds

we have the beds of the Millstone Grit series forming the cap-rock of many of the summits, and reaching their greatest thickness, that is to say, with most of the bands not disintegrated away, in Great Whernside, Penhill and Lovely Seat.

East of Leyburn the moorlands cease, and the district which the Yore drains on the north becomes still narrower than before. On the south side of the river we have now an undulated moorland gritstone country, sloping suddenly towards the east, and penetrated by a eugeogenous dale, the stream of which runs from west to east and has numerous branches. It is about ten miles in length, and the dale is called Colsterdale. The town of Masham stands upon the banks of its stream not far from the point where it joins the Yore, the latter being here 250 feet above the sea-level, and the top of the ridge which separates Colsterdale from Coverdale being upwards of 1500 feet above it.

From Leyburn to its junction with the Swale the Yore has a course of nearly thirty miles and through the low country it runs with many windings in a south-eastern direction. Soon after it has passed Masham it becomes the boundary of the North Riding on the south. The gritstone still continues along the banks of the river as far as Tanfield, through the woods opposite the pleasant undulated sylvan grounds of Hackfall. On the north side of the stream we have here *Viola sepincola*, *Symphytum tuberosum*, *Carex strigosa*, *Bryum uliginosum* and *Hypnum pratense*. A tract of Magnesian Limestone bounds the Gritstone on the east, the beds of which extend from Thornton Watlass past Well and Nosterfield, and form a narrow terrace, which, although it scarcely attains anywhere an altitude above the sea-level of 100 yards, yet has a slope in the direction of the dip of its beds towards the Central Valley. The limestone rocks form rapids in the bed of the stream below Tanfield bridge, and margin its northern bank with low cliffs for a short distance. This little tract of Magnesian Limestone, here as southwards, produces several interesting

plants, especially of the Xerophilous category, of which the following seem to be the most noteworthy:

Helleborus viridis
Astragalus glycyphyllos
Onobrychis sativa
Spiræa Filipendula
Caucalis daucoides
Hieracium murorum
„ *cæsium*
Campanula glomerata
Specularia hybrida
Salvia Verbenaca
Calamintha Acinos
„ *Nepeta*
„ *officinalis*
Lithospermum officinale
Salix rubra
Epipactis ovalis
Orchis pyramidalis
Ophrys apifera
„ *muscifera*
Bromus erectus

Aulacomnion androgynum
Bryum pallescens
„ *pendulum*
Amblystegium fluviatile
„ *irriguum.*

The remaining portion of the district belongs to the Central Valley. The stream is the boundary of the Riding and the tract which it drains on the north varies from two to four miles in width. The city of Ripon stands upon the edge of the Magnesian Limestone not far from the river immediately opposite the part we have now reached. Hutton Moor was once a tract of low sandy heatherland but it is now cut through by the railway and almost entirely enclosed. The following are the rarer plants of the road-sides, fields and stream-side in the vicinity of Hutton Conyers:

Myosurus minimus
Spergularia rubra
Ornithopus perpusillus
Vicia sylvatica
Sambucus Ebulus
Filago minima
Erigeron acris
Jasione montana
Salvia verbenaca
Pyrola media
Iris fœtidissima
Carex pseudo-cyperus

Leptobryum pyriforme

At Myton the Swale and Yore join, the river now bearing the name of Ouse and keeping it till it opens out into the Humber estuary.

In plants of the Montane category this district is about upon a par with West Swale, the two being considerably below West Tees and considerably above any of the others. In plants of the Xerophilous category the district is about upon a par with

West Swale and Derwent, these three being considerably above any of the others. The district contains only a very limited tract of the Central Valley and for plants of the Hygrophilous category is below all the others except West Tees and Esk; and for the Rarer Ascending Species it is below West Swale, East Tees, East Swale and Derwent.

GEOGRAPHICAL ANALYSIS OF THE FLORA OF THE YORE DISTRICT. AREA 260 SQUARE MILES.

CATEGORY.	Number of Species.	Per Centage of total native flora.
1 Montane Species	58	9
2 Xerophilous ,, ...	49	8
3 Maritime ,, ...	2	—
4 Hygrophilous ,, ...	37	6
5 General Ascending Species	362	57
6 Scattered Ascending ,,	115	18
7 Local Ascending ,,	11	2
8 Colonists	53	
9 Denizens	19	
Total number of the species.	706	

THE

NIDD AND WHARFE DISTRICT (No. 6)

(THE AINSTY).

[This district fits in most naturally with the West Riding and has been included by Mr. Lees in his Flora of 'West Yorkshire.' If I were now writing for the first time I should have omitted it.]

This district is considerably smaller and contains within its limits much less variety of situation than any of the others. It is eighty-four square miles in area, being bounded on the north by the Nidd, on the east by the Ouse, on the south by the Wharfe, and on the west by a conventional line drawn from Cattal on the Nidd to the Wharfe side between Thorpe Arch and Wetherby. The city of York is about midway between the two points where the Nidd and the Wharfe join the Ouse, about half of it being situated on the west side of this latter river. The Magnesian Limestone forms a sloping bank along the north side of the Wharfe as far westward from Thorpe Arch as the district extends, and the remainder of it, fully eighty square miles, belongs to the Central Valley. There are no streams of any considerable size which run through the district, but the rivers which bound it on three sides are large and fine. As in the rest of the Central Valley, the ground varies very slightly in level and nowhere attains an elevation above the sea of one hundred yards. The soil is sometimes clayey, but more often light and sandy, especially in the north-east. Besides York and Acomb the district contains several pleasant rural villages, which are separated from one another by well-cultivated fields, intersected by long winding grassy lanes, and in addition to these, two lines of main road and three of railway run through it, and the towns of Boston Spa and Tadcaster are situated just beyond its limits.

The best botanical localities are Askham Bogs and the sloping wooded bank of Magnesian Limestone which margins the Wharfe above Thorpe Arch. At Thorpe Arch, as at Tanfield, the most noteworthy plants of the limestone are species which range under the Xerophilous category. The following is the Thorpe Arch list:

Thalictrum flexuosum
Aquilegia vulgaris
Actæa spicata
Cochlearia officinalis
Helianthemum vulgare
Viola hirta
Stellaria nemorum
Hypericum montanum
Astragalus glycyphyllos
„ *Hypoglottis*
Spiræa Filipendula
Rosa Sabini
„ *micrantha*
Epilobium angustifolium
Pastinaca sativa
Caucalis daucoides
Sambucus Ebulus
Galium tricorne
Asperula Cynanchica
Scabiosa columbaria
Helminthia echioides
Picris hieracioides
Solidago Virgaurea
Inula Conyza
Specularia hybrida
Chlora perfoliata
Linaria Elatine
Lathræa squamaria
Calamintha Acinos
Lithospermum officinale
Neottia Nidus-avis
Orchis pyramidalis
Ophrys apifera
„ *muscifera*
Epipactis media
Narcissus pseudo-narcissus
Convallaria majalis
Melica nutans
Glyceria distans
Brachypodium pinnatum
Hordeum sylvaticum
——
Gymnostomum tenue
Pottia Heimii.

Askham Bogs are one of the most interesting of those carrs of the Central Valley of which mention has been made. They are situated by the side of the North Eastern railway not far from Copmanthorpe station, and consist of several acres of ground which is quite undrained. They yield *Cladium Mariscus* and abundance of *Carex paradoxa*, and are bounded by brown peaty ditches, and in some places are overgrown by aboriginal trees and brushwood, Alder, *Rhamnus Frangula*, *Myrica Gale*, and *Osmunda regalis* in beautiful condition, in addition to which the following interesting plants occur:

Ranunculus trichophyllus
,, *Lingua*
Rubus plicatus
Myriophyllum alterniflorum
Parnassia palustris
Carduus pratensis
Rumex Hydrolapathum
Hydrocharis Morsus-ranæ
Lemna trisulca
Juncus obtusiflorus
Carex stricta
,, *pseudo-cyperus*
Arundo Calamagrostis
——
Lastrea Thelypteris
,, *cristata*
Leskea polyantha.

Carex paradoxa grows also in a similar but smaller carr which is situated between the villages of Healaugh and Askham Richard. The following plants grow about the brick-ponds at Hob Moor, on the western outskirts of York :

Cochlearia officinalis
*Villarsia nymphæoides**
Veronica triphyllos
Hydrocharis Morsus-ranæ
Typha angustifolia
Lemna trisulca
Carex axillaris
,, *pseudo-cyperus*
——
Barbula rigida.

The following are the rarer plants of the sandy tract which extends from Holgate and Acomb southward and westward :

Myosurus minimus
Alyssum calycinum
Arabis hirsuta
Sagina ciliata
Geranium pyrenaicum
Trifolium scabrum
Ornithopus perpusillus
Vicia lathyroides
Sedum Telephium
Pimpinella magna
Lactuca virosa
Filago minima
Veronica triphyllos
Marrubium vulgare
Allium oleraceum.

The following are the rarer plants of the foot of the city-walls, the meadows on the west side of the Ouse, and other places in the immediate neighbourhood of York :

Barbarea stricta
Saponaria officinalis
Cerastium aquaticum
Trifolium fragiferum
Epilobium roseum
Picris hieracioides
Salvia Verbenaca
Chenopodium olidum
,, *urbicum*
Chenopodium murale
Atriplex deltoidea
Polygonum mite
,, *minus*
Rumex aquaticus
,, *palustris*
Potamogeton flabellatus
Festuca rigida.

Several of the common Ericetal plants and of the frequent Sylvestral plants of the dales seem to have disappeared from this highly cultivated district. Of the Montane plants it has only seven of the commoner species and these are almost, if not quite, restricted to the calcareous undulations in the vicinity of the Wharfe. In Xerophilous and Hygrophilous plants it occupies an intermediate position amongst the districts, and although it is much smaller than any of the others, yet for the Rarer Ascending Species one district is below it.

GEOGRAPHICAL ANALYSIS OF THE FLORA OF THE NIDD AND WHARFE (AINSTY) DISTRICT. AREA 84 SQUARE MILES.

CATEGORY.	Number of Species.	Per Centage of total native flora.
1 Montane Species	7	1
2 Xerophilous ,, ...	34	6
3 Maritime ,, ...	—	—
4 Hygrophilous ,, ...	55	8
5 General Ascending Species	362	64
6 Scattered Ascending ,,	106	19
7 Local Ascending ,,	13	2
8 Colonists	65	
9 Denizens	18	
Total number of species.	660	

THE EAST TEES DISTRICT (No 5).

This includes the western portion of Cleveland. A large proportion of its watershed on the east and south reaches into the Middle Zone, but, unlike the Esk district, it does not include any considerable tract of heatherland within its limits, and the greater part of its surface is under one hundred yards above the sea level. The main stream of Tees forms the boundary of the district on the north-west, and a branch of moderate size, which is called the Leven, runs through it from east to west.

The higher hills along the line of watershed are all capped by the Sandstone of the Lower Oolite, the maximum thickness of which, in this tract, is under three hundred feet. Below it, occupying the steep slope of the moorlands, and spreading out for a considerable breadth round their base, stretch the Liassic beds, with a maximum thickness of 850 feet; and west of the line where the Lias ceases there is fully one-half of the district which belongs to the great Central Valley.

The southern fork of the Leven rises on the edge of the Middle Zone in front of Burton Head (1489 feet), the loftiest of the East Yorkshire peaks. From the top of this hill there is a very fine and extensive view of the dales of the Esk and the Derwent and the moorlands which surround them, over the low-lying cultivated Cleveland country on the north, of Kildale Moor and the wooded basaltic ridge and the peak of Roseberry Topping rising behind it, and, further to the west, of the Tees estuary and the long winding line of the Durham coast as far as Hartlepool and Sunderland and the mouth of the Tyne. From this culminating peak a line of high moorland, with an abrupt westward slope, runs in a northern direction towards another branch of the same stream. From Burton Head another line of high moorland runs also due west, the highest peaks being immediately over the edge of Cleveland, and the Cleveland streams, the

branches of the southern fork of the Leven, scarcely penetrating the moorland mass, whilst on the south of the peaks there is an extensive area of hill-country and the streams have to run down long dales before they reach the open valley. At the head of Bilsdale, which is the hollow immediately west of Burton Head, the pass is under 300 yards, and the Oolitic Sandstone quite cut through. West of this we have the Wainstones (1317 feet), Cranimoor (1427 feet), and Carlton Bank (1338 feet), bare undulated peaks separated from one another by the glens which unite to form Bilsdale : and still further to the west the watershed ridge reaches 1048 feet over Whorlton and Swainby, from which point the boundary line of the hill-country sweeps abruptly round towards the south. Along the line of this hill-bank, which bounds Cleveland on the south, the Lias attains an elevation of 1200 feet and the slope from the top of the hills down to about 100 yards is very sudden. Along the crest of the hill the Oolitic Sandstone forms crags at several points, the bank being in some places bare and shaly and in others overspread with fir plantations. In one place only is there a rounded knoll of hill insulated from the principal mass, and that is in the neighbourhood of Whorlton, towards the western extremity of the embankment. The southern branch of the Leven runs parallel with the bank at a short distance from its base, and although several small streams have their rise upon this hill-side, only one of them has a dale, and that is called Scugdale, and is situated also near the western extremity of the ridge. The following are the rarer plants of the woods and rocks and hill-slopes from Battersby westward by way of Burton Head and Ingleby Greenhow to the neighbourhood of Stokesley :

Drosera anglica
Rubus plicatus
„ *mucronatus*
Ribes alpinum
Hieracium gothicum
„ *crocatum*
Juniperus communis
Andreæa Rothii
Gymnostomum rupestre
Brachyodus trichodes
Blindia acuta
Dicranum fuscescens
Distichium capillaceum
Grimmia trichophylla

Orthotrichum pumilum
Ulota phyllantha
Amphoridium Mougeotii
Zygodon conoideus
Tetrodontium Brownianum
Aulacomnion androgynum
Webera cruda
Zieria julacea
Mnium subglobosum
Mielichoferia nitida
Philonotis calcarea
Bartramia Halleriana
„ *Œderi*
Discelium nudum
Fissidens pusillus
Schistostega osmundacea
Hypnum stramineum
„ *exannulatum*
Eurhynchium crassinervium.

The more northern branch of the Leven, of which mention has been already made, has its rise in the recesses of the hill-country, and runs for some distance down a dale, the only dale of any considerable size which there is in this drainage district. By one of the forks of this branch which runs down a deep lonely gill a triangular tract of hill is separated from the main mass. The glen is called Lounsdale and the hill Kildale Moor, and it reaches an altitude of 1064 feet. The main dale of this northern branch of the Leven is called Kildale. The pass from its upper extremity into one of the branch dales of the Esk does not reach the height of the Oolite, which here descends considerably lower than at Burton Head, and the North Yorkshire and Cleveland Railway now margins its stream, and runs across the narrow heathery pass into Eskdale. The basaltic dike from Ayton passes through Kildale Moor, and ascends Kildale in the direction of Castleton, and in some places woods and fir plantations stretch up the slope of the hill to the edge of the heather. The following are the rarer plants of Kildale and Lounsdale:

Geranium sylvaticum
Rubus plicatus
„ *mucronatus*
„ *Sprengelii*
Epilobium angustifolium
Ribes alpinum
Hieracium gothicum
Carex stricta
„ *pendula*
Arundo Calamagrostis
„ *Epigejos*
Festuca pseudo-myurus

Andreæa Rothii
Sphagnum fimbriatum
Dicranum rufescens
Hedwigia ciliata
Grimmia trichophylla
Diphyscium foliosum
Tetraplodon mnioides
Hypnum stramineum.

Opposite the north-west corner of Kildale Moor is the singular hill called Roseberry Topping. It is a rounded knoll of hill, sharply insulated from the main mass of the moorland, standing boldly out against the level country, and forming a conspicuous object from the surrounding plain and the valley far away. It is capped with a crag of Oolitic Sandstone and attains an elevation of 1057 feet. In hedges at the little village of Newton, which lies immediately beneath it, and 700 feet below its summit, *Rosa hibernica* grows. From Kildale Moor the basaltic dike passes on the south side of Roseberry Topping, and underlies a wooded ridge about 200 yards in height behind the village of Great Ayton, from which point it declines westward past Langbargh till it is lost beneath the New Red Sandstone of the Central Valley. Above Ayton it is called Cliff Rigg, above Langbargh, Langbargh Rigg. In two or three places by the side of the stream near Ayton are bushes of *Salix acutifolia*. The following are the rarer plants of the woods and fields of the basaltic dike in this vicinity :

Viola hirta
Medicago maculata
Trifolium striatum
Spiræa Filipendula
Rubus mucronatus
Rosa gracilis
Poterium Sanguisorba
Sedum anglicum
Scabiosa Columbaria
Tragopogon porrifolius
Campanula Rapunculus
Lamium Galeobdolon
Narcissus pseudo-narcissus
Allium Scorodoprasum

Hedwigia ciliata.

Not far from the western edge of the Lias there is an insulated mass of hill, called Eston Nab, which is capped with Oolitic Sandstone, and attains an altitude of 800 feet. It immediately overlooks the Tees estuary, and the Ironstone beds of the Lias are worked largely upon its sea-ward slope. The two branches of the Leven the course of which we have been tracing unite near the town of Stokesley, and the stream flows with many windings in a north-western direction past Hutton Rudby and Hilton through the Central Valley portion of the district and falls into the Tees between Yarm and Stockton.

The course of the main stream of Tees we have still to follow. It is now a fine large river, and flows with many windings through a richly-cultivated flat country. Along the edge of this drainage-district its general course is towards the north-east, and its banks about Middleton and Dinsdale are often steep and pleasantly wooded. The town of Yarm is on the Yorkshire side of the river not far from the mouth of the Leven. From Yarm up the stream to Worsall is a pleasant sail by boat when the tide is high. Five miles north-east of Yarm is the town of Stockton-on-Tees, the principal part of which stands upon the Durham side of the stream. The following are the rarer plants of the woods and low marshland and sandy fields near the Tees in the neighbourhood of these two towns:

Nymphæa alba
Trollius europæus
Lepidium latifolium
Saponaria officinalis
Cerastium aquaticum
Myriophyllum verticillatum
Œnanthe crocata
„ *Lachenalii*
Epilobium angustifolium
Galium boreale
Campanula glomerata
Epipactis media
Orchis pyramidalis
Butomus umbellatus
Sagittaria sagittifolia.

The thriving town of Middlesbrough, with its docks and blast-furnaces, stands upon the Yorkshire shore just where the river begins to open out into an estuary. A list of the introduced plants of the ballast-hills in the neighbourhood of this town will be given hereafter. From Middlesbrough to Redcar the coast is margined by a series of low marshy fields, intersected by tidal ditches,* in front of which the shore-line is bounded in some places by low undulated sand-hills. The railway runs not far from the sea in a direct line between the two points, beneath Eston Nab and the woods of Wilton, and in front of the long straggling village of Coatham. The following are the rarer plants of the salt-water ditches, sand-hills and salt-marshes of this part of the coast, which is, as has been already remarked, the only portion of the North Yorkshire sea-line which furnishes a good supply of the characteristically Maritime species:

* For a broad open ditch, either of fresh or of salt water, 'stell' is here the local name.

Thalictrum minus
Ranunculus Baudotii
„ *hirsutus*
Cakile maritima
Crambe maritima
Lepidium latifolium
Sinapis tenuifolia
„ *muralis*
Viola hirta
Silene maritima
Sagina maritima
Honckeneja peploides
Spergularia media
Stellaria Borœana
Cerastium tetrandrum
Geranium sanguineum
Trifolium fragiferum
Astragalus Hypoglottis
Eryngium maritimum
Apium graveolens
Sium latifolium
Helminthia echioides
Carduus tenuiflorus
Carlina vulgaris
Artemisia maritima
Convolvulus Soldanella
Salvia Verbenaca
Glaux maritima
Armeria maritima
Chenopodium urbicum
Atriplex portulacoides
„ *Babingtonii*
Atriplex deltoidea
„ *littoralis*
Beta maritima
Salsola Kali
Schoberia maritima
Salicornia herbacea
„ *radicans*
Triglochin maritimum
Zostera marina
Ruppia maritima
Zannichellia pedicellata
Juncus maritimus
„ *cœnosus*
Scirpus glaucus
„ *maritimus*
Carex extensa
„ *distans*
Phleum arenarium
Glyceria maritima
„ *distans*
„ *Borreri*
„ *procumbens*
„ *loliacea*
Triticum pungens
„ *acutum*
Elymus arenarius
Hordeum maritimum
Lepturus filiformis

———

Pottia Heimii
Trichostomum tophaceum.

The sand-hills of the coast-line between Redcar and Marske, like those between Redcar and Middlesbrough, yield some of the commoner Xerophilous species. Here occur *Cerastium arvense*, *Poterium Sanguisorba*, *Scabiosa Columbaria*, and *Astragalus Hypoglottis*.

This district has very nearly all the characteristically Maritime species which are to be met with anywhere in North Yorkshire, *Hippophae rhamnoides* and *Asplenium marinum* being the only exceptions. For plants of the Montane category it is third out of the four hilly districts of the east. Its Xerophilous plants

are few in number and rare, being very nearly restricted to the coast sand-hills and the basaltic ridge. For Hygrophilous plants it has five of the districts above, and three below it, and for the Rarer Ascending species only the much larger districts of Derwent and West Swale conspicuously exceed it.

GEOGRAPHICAL ANALYSIS OF THE FLORA OF THE EAST TEES DISTRICT. AREA 155 SQUARE MILES.

	CATEGORY.	Number of species.	Per centage of total native flora.
1	Montane Species	21	4
2	Xerophilous ,, ...	19	3
3	Maritime ,, ...	51	8
4	Hygrophilous ,, ...	38	6
5	General Ascending Species	362	57
6	Scattered Ascending ,,	128	21
7	Local Ascending ,,	11	2
8	Colonists	58	
9	Denizens	23	
	Total number of species	711	

THE ESK DISTRICT (No. 4).

This district includes the eastern portion of Cleveland. A large proportion of its surface is made up of undulated heatherland and broad ramified dales of the eugeogenous type of character. The Esk flows through the district from west to east, the principal dales which its branches run down being upon the south side of it. The line of watershed round the upper part of the river on the south extends into the Middle Zone; bnt on the north of the river the broad sweep of heatherland, which occupies the greater part of the surface between the Esk and the coast-line, nowhere from Castleton eastward reaches an altitude of 1000 feet, and is mostly considerably lower. It is a district of steep crumbling sea-cliffs and pleasant dales and undulated swells of low heatherland, but including very few ridges or peaks which reach even the Middle Zone, and very little low-lying flat country; and of our nine drainage districts this is the only one within which no portion of the Central Valley is comprised.

Throughout the district, except along the course of the basaltic dike, the Lower Oolite occupies the higher, and the Lias the lower levels of the surface. South of the Esk we have the Lias at an elevation of 1200 feet in Burton Head, and from thence declining due east to a height of rather more than 500 feet in the cliff on the south side of Robin Hood's Bay. The Esk runs in a synclinal depression of the strata, the Oolite coming quite down to the shore on the north side, and very nearly so in the cliffs on the south side of its mouth. But on the north side of the river the beds rise again, and we have the Lias at an elevation of nearly 1000 feet in Roseberry Topping and Guisbrough Moor, and from this point sinking to 180 feet in Huntcliffe, and 340 feet in the great cliff near Lofthouse.

Sleddale, the dale of the north-west branch of the Esk, begins not far from Roseberry Topping. At first its stream runs parallel with the Kildale branch of the Leven, and this dale is separated from Kildale only by a narrow ridge of hill. On the opposite, or north-eastern side of the dale, a ridge of moorland runs parallel with it for four miles, and attains an elevation of 1078 feet. The lower part of the dale is broad and open, and contains many farm-houses, surrounded by woods and cultivated fields. The following are the rarer plants of this dale and the surrounding moors :

Hypericum elodes
Myriophyllum verticillatum
Scirpus pauciflorus
Carex teretiuscula

Sphagnum molluscum
Gymnostomum rupestre
Cinclidotus fontinaloides
Mnium subglobosum
Anœctangium compactum
Camptothecium nitens
Hypnum stramineum
„ *giganteum.*

Castleton, the centre of population for the upper part of Eskdale, is situated near the point where the Sleddale stream unites with one which flows from the south-west. In addition to Sleddale, three of the branch dales from the south, Basedale, Westerdale, and Danbydale, all open out into the main dale of the Esk within a short distance of Castleton. The ridge of hill from Burton Head eastward along the line of watershed between Esk and Derwent reaches for several miles continuously into the Middle Zone, and Loose Howe Moor, at the head of Danbydale, attains an elevation of 1419 feet. The ridges of hill between these dales are narrow, and stand out boldly into the main dale of Esk. Basedale is a secluded, thinly-populated dale, with an abbey and thick fir-plantations ; Westerdale, a branched and more cultivated and populous hollow; and Danbydale from Castleton runs up due south into the recesses of the high anticlinal ridge which forms the drainage-summit. Neither about the Esk nor along the crest of the dales about Castleton, is there much rock to be seen, but everywhere pastoral farmhouses, and woods and green meadows emerging from beneath

the swelling curvatures of the lines of the heathery hills. The following are the more remarkable plants of this neighbourhood:

Geranium sylvaticum
Anthemis nobilis
Bidens tripartita
Vaccinium Oxycoccus
Myrica Gale
Juniperus communis
———
Audreæa Rothii

Dicranum fuscescens
Hedwigia ciliata
Grimmia trichophylla
Orthotrichum rivulare
Ulota Drummondii
Mnium stellare
„ *subglobosum*
Fontinalis squamosa.

From Castleton to the mouth of the Esk at Whitby the distance is fourteen miles, the course of the stream due east, and the fall in its bed but trifling. On the north-east of Castleton the moor attains an elevation of 988 feet in Danby Beacon, which commands an excellent view of a wide surface of heathery country on the north and north-east, diversified by tumuli and woods and glens, and bounded by the winding line of the coast. Lower down the river there is on the north a long narrow wooded glen called Stonegate Gill, and on the south three more of the branch dales, Great Fryupdale, Little Fryupdale, and Glaisdale. On the end of the spur of hill between Danbydale and Fryupdale stand the ruins of the old castle of the Bruces, from which Castleton takes its name, surrounded by plantations of feathery larches. There is a communication over a neck of land at their head between the two dales of Fryup, and on the end nearest the Esk of the ridge which separates them is Danby Crag, a sandstone edge with a dark holly wood upon its slope, and alder and birch below. There is above Lealholm bridge a pleasant steep wooded rocky glen, called Crunkley Gill, which is hemmed in upon one side by the termination towards the Esk of the ridge between Fryupdale and Glaisdale: and here grow *Fissidens pusillus*, *Hypnum pumilum*, and *H. heteropterum*. Opposite where Glaisdale opens out we have upon the edge of the heather at an elevation of about 200 yards, and at a distance from the Esk of a mile, the little town of Egton, and between Glaisdale and Goathland dale

is the most picturesque portion of the river. The channel of the stream is more or less rocky for a considerable distance. The basaltic dike, which from Castleton to this point runs along the south side of the dale, here crosses the stream, and forms a scar of dark-coloured rock upon its northern bank. The Esk flows in serpentine fashion beneath steep much-undulated spurs of rock-crested moorland, the summits of which rise to a height of 150 or 200 yards above it, and the slopes of which towards the river are covered with wood, partly natural and partly planted. On the north side of the stream rises the basaltic crag of Limber Hill; on the south for a mile the woods of Arncliffe border it; and beyond them, at the bottom of a nest of hills which surround it upon every side, except where the streams break through them, is the village of Egton Bridge. This is a favourite place for excursionists from Whitby, and is easily reached by the railway, which runs from Whitby up the main dale of Esk to Castleton and Stokesley, and at the bottom of Goathland dale is joined by a branch that runs due south. There is a station at Grosmont, the site of an old priory, and now the centre of the mining industry of Eskdale, which is situated a mile to the east of Egton Bridge.

Goathland dale is much the largest of the branch dales of this district. At first it is an open moorland glen, surrounded by hills which are considerably lower than the Loose Howe and Burton Head peaks. Its western branch is called Wheeldale, and is a rocky sylvan glen, upon the stream of which there is a waterfall, called Nelly Ayre Foss, over an edge of sandstone some forty feet in depth. The branch of the stream along which the railway runs is called Eller Beck, and this also has several easily accessible waterfalls upon it, the best known of which, Thomasson's Force, is very near the top of the railway incline, from which it is approached up a winding rocky glen. The following are the rarer plants of Goathland dale and the neighbourhood of Egton Bridge:

Corydalis claviculata
Euonymus europæus
Inula Helenium
Lathræa squamaria
Myrica Gale
Neottia Nidus-avis
Narcissus pseudo-narcissus
Schœnus nigricans
Scirpus pauciflorus
Carex lævigata
„ *pendula*
Osmunda regalis
Equisetum hyemale

Sphagnum compactum
Distichium capillaceum
Didymodon cylindricus
Orthotrichum rivulare
Amphoridium Mougeotii
Mnium stellare
Entosthodon Templetoni
Fissidens osmundoides
Heterocladium heteropterum
Plagiothecium silesiacum.

On the drainage-ridge east of Goathland dale Lilla Howe Cross attains an elevation of 1,000 feet, at a distance of five miles from the sea. From this peak an almost unbranched sylvan glen, called Iburndale, runs down to the Esk. Its stream is called Little Beck, and it has a fine waterfall upon it, which is called Falling Force, and of which the hard arenaceous Dogger beds form the cap-rock. These waterfalls of the branch dales of the Esk are all within the compass of a day's excursion from Whitby, and they are the only falls of any considerable size which we have on the east of the Central Valley. Below Sleights, and where Iburndale opens out, the main dale of Esk widens, and the stream curves gradually round towards the north. The heather is now left behind, and there are several villages of considerable size amongst the undulated ground which margins the stream upon both sides as we approach its mouth. At Ruswarp it receives on the south the stream of another dale, which penetrates the moors in the direction of the Derwent, and winding past pleasant woods, and heights diversified by halls and homesteads, it flows beneath the steep craggy banks upon the slope and summit of which the town of Whitby is built into the ocean. The rarer plants of the lower part of the dale are:

Trollius europæus
Hypericum Androsæmum
Lathyrus sylvestris
Campanula patula
Linaria repens
Lamium Galeobdolon
Lastrea Fœnisecii

Barbula latifolia
Orthotrichum Sprucei
Mnium serratum
Heterocladium heteropterum.

We must now go back again to Roseberry Topping, and make the circuit of the coast. From Roseberry a line of high moor runs towards the sea in a north-eastern direction, with a steep slope towards the north-west. Amongst the undulations of the hill a pleasant stream takes its rise, which soon reaches the foot of the slope, and then flows down a wooded glen, in a channel diversified by rock in several places, to fall into the sea at Saltburn. The town of Guisbrough stands upon the banks of the stream at a distance of five miles from the sea, and at an elevation above it of not more than 100 yards. Immediately in front of the town the moor rises to a height of 700 feet above it, the steep slope covered with fir-plantations and bilberry bushes, and crested by a fine crag of the freestone of the Lower Oolite, which is called Highcliff; and behind the town the swelling curves of Eston Nab rise to shut out the view of the Tees estuary. The rarer plants of the neighbourhood of Guisbrough are:

Sinapis tenuifolia
Geranium sylvaticum
Hieracium tridentatum
Atriplex littoralis
Juniperus communis
Epipactis ensifolia

Sphagnum fimbriatum
Dicranum fuscescens
Orthotrichum tenellum
Tetrodontium Brownianum.

From Marske to Saltburn the coast is bounded by banks of sand and diluvial clay, which grow higher and higher towards the east, and inland are the hall and woods of Upleatham, upon the slope towards the east of a rounded hill of Lias, of which the summit is 550 feet above the sea. The view from Upleatham of the hollow of the stream which flows from Guisbrough to Saltburn, of the grey old castle of Skelton, and its environing woods upon the opposite slope, and of the village of Brotton and its church upon the summit of the bare ridge above, is very fine. From the Tees mouth as far eastward as the Saltburn stream, a beautiful sweep of hard sand, which is

more or less covered at high water, stretches along the foot of the sea-bank and sand-hills; and west of this rising watering-place the cliffs begin, to continue, with breaks, almost till the Esk is reached. The following are the rarer plants of the woods and sea-shore in this neighbourhood:

Thalictrum minus
Cakile maritima
Helianthemum vulgare
Silene maritima
Euonymus europæus
Medicago maculata
Spiræa Filipendula
Rosa Sabini
Scabiosa Columbaria
Helminthia echioides
Carduus tenuiflorus
Artemisia maritima
Ligustrum vulgare
Atropa Belladonna
Salvia Verbenaca
Marrubium vulgare
Samolus Valerandi
Carex pendula
Calamagrostis Epigejos
Triticum junceum

Fissidens crassipes.

The streams of that portion of the coast which we have now reached have their rise amongst the broad surfaces of heather-land which ascend from the north bank of the Esk, and of which Danby Beacon is the culminating peak. Beginning in heathery glens, they soon sink through the Oolitic beds, and growing gradually larger as they descend, are often bordered with thick woods in the lower part of their course. Upon the sea-margin, or within a short distance of the coast, there are in the breaks of the hill-country several villages of moderate size, partly agricultural and partly maritime, with a strong dash interfused of the iron- and alum-mining element; and between the gills which contain these streams and woods and villages, the spurs of the hill-country stretch out to form along the shore-line a series of magnificent precipices, the barriers which guard this prominent line of coast, bulwarks which as year follows year, and summer succeeds to spring, and winter to autumn, in unvaried cycle of repetition, the waves of ocean ceaselessly beat against.

The first crag, Huntcliffe, begins at Saltburn, and forms a prominent object in the view from Redcar and the Tees mouth. The greatest height which it reaches is 260 feet, and

the lower part is composed of the Lower Lias Shale, and the upper part of the hard Ironstone and Marlstone beds, the whole being surmounted by a cap of glacial drift. The more notable plants of Huntcliff are *Crambe maritima*, *Brassica oleracea*, *Silybum Marianum*, and *Schistidium maritimum*. Then comes the Skinningrove hollow and the pleasant sylvan stream and glen of Lofthouse, and beyond it the great cliff of Boulby, the loftiest of all the English coast-crags. This stands boldly out against the sea, and is altogether 679 feet in height, the cap-rock being the hard arenaceous beds of the Lower Oolite, and the lower part shewing an excellent section of the Lias from its latest deposits down to a depth of 100 feet in the Lower Shale. Then comes the Staithes hollow, with its branched glen, beyond which the coast takes a more decidedly southern direction than heretofore. By the Staithes fault we have the strata depressed so that the Ironstone and Marlstone beds are brought down to the shore, and between Staithes and Sandsend the Oolite everywhere extends down to the sea-cliffs, except at Runswick Bay, the highest crag of this part being south of Kettleness, 370 feet in height. This grand sweep of craggy coast is now penetrated by the railway between Saltburn and Whitby, and is thus brought within the range of easy access to tourists, and it is to be expected that it will be more visited, and become better known than it has been. The tide is often inconvenient for paying a visit to the crags from below, and to skirt their upper edge necessitates a good deal of rough scrambling, but to those who are able to make it, and who care for either magnificent scenery or geology, the walk between Saltburn and Whitby will richly repay the exertion.

At Sandsend the cliffs terminate and inland is the Mulgrave hollow, penetrating to the Lias, with its two streams and undulated shadowy woods, and antique and modern castles. The following are the rarer plants of these woods and the adjacent sea-shore :

Lepidium latifolium
Honckeneja peploides
Cakile maritima
Geranium sylvaticum
Vicia sylvatica
Rosa micrantha
Lactuca virosa
Inula Helenium
Pyrola media
Salvia Verbenaca
Origanum vulgare
Atriplex Babingtonii
Neottia Nidus-avis
Carex pendula
Osmunda regalis.

From Sandsend to Whitby the coast is guarded by banks of glacial clay, similar to those which occur between Marske and Saltburn. This is the tract of the lowest depression of the strata. The Lias is not anywhere to be seen, and the Oolite forms the foundation of the sea-bank, from the base of which extends a beach of sand, the greater part of which is overflowed at high water. The following are the rare plants of the sea bank, and maritime plants of the shores of the Esk and other places in the neighbourhood of Whitby:

Glaucium luteum
Cakile maritima
Crambe maritima
Brassica oleracea
Sinapis tenuifolia
„ *muralis*
Honckeneja peploides
Spergularia media
Cerastium tetrandrum
Medicago maculata
Vicia sylvatica
„ *bithynica*
Parnassia palustris
Smyrnium Olusatrum
Apium graveolens
Helminthia echioides
Carduus tenuiflorus
Artemisia maritima
Glaux maritima
Armeria maritima
Statice Limonium
Atriplex Babingtonii
„ *deltoidea*
Salicornia herbacea
Hippophae rhamnoides
Scirpus maritimus
Carex extensa
Glyceria maritima
„ *distans*
„ *procumbens*
Bromus tectorum *
Triticum junceum
Lepturus filiformis

Pottia Heimii
Barbula vinealis
Bryum uliginosum
Hypnum polygamum.

From the Esk southward the beds rise in the direction of the anticlinal axis. Between Whitby and Baytown extends a continuous range of cliffs, the highest of which is under 200 feet in altitude. At first the Upper Lias Shale occupies the shore, and at Hawsker only a small depth of it is seen, and

inland we have the calcareous bed of the Lower Oolite over a thick mass of its Lower Sandstones and Shales. From this point southward the rise in the beds is sudden. Before Baytown is reached both the two lower sets of Liassic beds make their appearance in the cliffs. They sweep round the slope of the undulated hollow at the bottom of which the little town is situated, overlaid along the shore-line at the bottom of the hollow with banks of drift. The Peak cliffs, on the south side of the bay, are the termination against the coast of the line of high land which forms the ridge of watershed between Esk and Derwent. They are 600 feet in altitude, and exhibit lower beds of the Lias than are to be seen anywhere else in North Yorkshire.

Interesting as it is in respect of scenery and geology, this district is not rich botanically. Its hills are not high enough to produce a large number of the Montane species. It has only one thin bed of limestone amongst a thick mass of shales and sandstones, and its Xerophilous plants are few in number and rare. Its shore-line is guarded mostly by steep and crumbling cliffs, upon which very few of the characteristically Maritime species grow. It does not contain within its limits any low-lying level country, and for the Rarer Ascending species is considerably under the average of the districts. It is richest in the ericetal and sylvestral flowering plants and mosses which affect low hilly tracts.

GEOGRAPHICAL ANALYSIS OF THE FLORA OF THE ESK DISTRICT. AREA 235 SQUARE MILES.

CATEGORY.	Number of species.	Per centage of total native flora.
1 Montane Species	20	3
2 Xerophilous ,, ...	18	3
3 Maritime ,, ...	33	6
4 Hygrophilous ,, ...	19	3
5 General Ascending Species	362	63
6 Scattered Ascending ,,	116	21
7 Local Ascending ,,	13	2
8 Colonists	49	
9 Denizens	22	
Total number of species ...	642	

THE DERWENT DISTRICT (No. 3).

This district contains upwards of one-fourth part of the whole of North Yorkshire, and is more than five hundred square miles in area, so that it is one-half the size of an average English county. It has a sea-line which is sixteen miles in length from north to south, and from the coast to the watershed ridge on the west the distance is forty miles. Physically it consists of five tracts of country, as follows :—

1. *The Eugeogenous hills.*—These are a range of undulated hills which extend southward from the watershed ridge which separates the tributary branches of Derwent from those of the Esk and Tees, and which, with the dales that intersect it, fills up the whole of the northern portion of the district. A line may be drawn for nearly forty miles from west to east along the ridge of these uncultivated moorlands, but from north to south the total breadth of this range is under ten miles. Like the Cleveland hills, they consist of Lower Oolitic strata based upon Lias. The dales are comparatively broad and open, and their streams run from north to south. As has been already stated, the culminating peak of the main ridge is the hill (Burton Head) from which branches of the Esk, Leven, and Derwent all flow. This is distant twenty-five miles from the point of coast which is due east of it, and in an eastern direction from Burton Head the ridge declines, at first gradually, and afterwards more suddenly, in altitude, heing 880 feet lower against the coast than in the summit-peak, which gives an average declination of 35 feet per mile. The ridges which divide the dales are in some cases almost as high as the main ridge, as will be explained when we come to speak of the dales in detail. This tract margins the coast from the anticlinal axis southward as far as Scarborough, which is fully three-fourths of the total sea-line of the district.

2. *The Dysgeogenous hills.*—These are a range of calcareous hills which are somewhat lower in altitude than those which have been already mentioned, and which extend from the coast at Scarborough westward as far as the watershed of the district in that direction. They are due south of the hills of the eugeogenous range, and based upon their slope, with usually a steep escarpment towards the north, and a gradual slope in the direction of the low level country which borders them on the south. In breadth from north to south they vary from four to ten miles. The streams which take their rise amongst the northern range have to run through that of which we are now speaking before they reach the Derwent. These hills are usually much drier and more grassy than the others, the slopes of those parts of the dales which they enclose being steep, and often covered with dense woods. The range is also highest towards its western extremity, and grows gradually lower as we pass eastward. It margins with low cliffs the greater part of the coast from Scarborough southward to Filey.

2. *The Vale of Pickering.*—This is a tract of flat low-lying cultivated country on the south of the calcareous hills, which extends from the coast inland for thirty miles. A large portion of it is not elevated so much as 100 feet above the sea-level, and the vale is much intersected by streams, and contains a considerable surface of carrs and low marsh-land. The Derwent runs through it from east to west, and forms the boundary of North Yorkshire on the south; and upon that side the Vale is bounded by the Chalk Wolds of the East Riding. With the exception of Scarborough, all the towns of the drainage district are either actually in this tract or very near the edge of it.

4. *The Howardian tract.*—This comprises two narrow parallel terraces, which extend from the calcareous hills eastward to the Derwent, and which are situated on the south-west of the Vale of Pickering, and separate it from the great Central Vale of York. The northern terrace is composed of calcareous rocks of

the Lower Oolite, and its highest point is under 400 feet above the sea-level: the southern one of Lower Oolite based upon Lias, and its highest point is under 600 feet: and both of them decline gradually in elevation from north-west to south-east.

5. South of the Howardian tract the district contains a small portion of the great Central Vale.

We will take the coast-line first, and then the hill-country and the dales, proceeding in order from east to west.

From the High Peak southward as far as Hayburn Wyke we have a grand range of cliffs, which between these two points, a distance of four miles, sinks in altitude from 595 to 296 feet high water mark. These precipices show a complete series of the beds of rock from the Lower Oolite down to the Lower Lias Shale. At Hayburn Wyke is the mouth of a secluded branched glen from the west and north-west, which is called Staintondale. Past Cloughton and Scalby the cliffs are lower, and the beds dip rapidly in a southern direction. At Cloughton Wyke the calcareous band of the Lower Oolite occupies the shore. At Scalby is the mouth of another little stream, which is connected with the Derwent by what is called the New Cut. Towards Scarborough the Upper Sandstones of the Lower Oolite, with drift over them, form a cliff of under 200 ft. in height. The Castle Hill at Scarborough is composed of an outlying mass of the hard calcareous rocks of the Middle Oolite, which form here a bold rocky promontory, which rises to a height of 300 feet, and stands out abruptly against the sea, and has the sea flowing round three-fourths of its circumference. The town of Scarborough is situated upon the low diluvial sea-bank which this promontory guards, and inland from it extends the lowest ground which we have upon this line of coast, and a calcareous nab, called Oliver's Mount, rises abruptly from this low ground to a height of 510 feet, with a steep escarpment towards the north, and with what was once a sedgy mere at its base, but which is now greatly reduced by drainage. The

following are the rarer plants of the shores, the slopes and cliffs of the Castle Hill, and other places in this neighbourhood :

Ranunculus Lingua
Cakile maritima
Sinapis tenuifolia
Sagina ciliata
Arenaria Lloydii
Honckeneja peploides
Spergularia media
Medicago maculata
„ *denticulata*
Trifolium scabrum
„ *striatum*
Astragalus glycyphyllos
Lathyrus sylvestris
Epilobium angustifolium
Sedum anglicum
Smyrnium Olusatrum
Apium graveolens
Sambucus Ebulus
Helminthia echioides
Picris hieracioides
Lactuca virosa
Silybum Marianum
Carduus eriophorus
Bidens cernua
Inula Helenium
Chlora perfoliata
Atropa Belladonna
Linaria spuria
„ *Elatine*
Salvia Verbenaca
Calamintha officinalis
Samolus Valerandi
Atriplex arenaria
„ *littoralis*
Salsola Kali
Rumex maritimus
Orchis pyramidalis
Narcissus pseudo-narcissus
Butomus umbellatus
Triglochin maritimum
Potamogeton gramineus
„ *rufescens*
„ *lucens*
Carex stricta
Milium effusum
Glyceria maritima
„ *procumbens*
„ *loliacea*
„ *distans*
Asplenium marinum
Hymenophyllum Tunbridgense
Pilularia globulifera
Equisetum hyemale

Trichostomum crispulum
„ *mutabile*
Tortula rigida
„ *papillosa*
Grimmia maritima
Ulota phyllantha
Bryum uliginosum.

Oliver's Mount is an outlying spur of the calcareous range. Between Scarborough and Filey the highest point of the cliff is under 300 feet above high-water mark. From Scarborough as far as Ewe Nab the Upper Sandstones of the Lower Oolite form the greater part of the cliff, and the calcareous band may be seen beneath them in several places. By a landslip in Cayton Bay we have the Oxford Clay brought down to the shore and over it there is a cliff of Calcareous Gritstone. North of the Redcliff fault we have all the beds of the Lower Oolite from the

Lower Calcareous Gritstone down to the Kelloways Sandstone. South of the fault in Gristhorpe cliffs we have a foundation of Lower Oolite, and above it a cliff of Middle Oolite, with the beds from the earliest deposit up to the same Lower Calcareous Gritstone. From this point the beds dip rapidly towards the south, the Calcareous Gritstone descending to the shore-level to form the conspicuous rocky promontory which bears the name of Filey Brig.

The main stream of Derwent is made up of numerous branches which rise amongst the heathery arenaceous moors a few miles inland from the coast, about midway between Whitby and Scarborough. From the great Peak cliff, the head of its eastern branch is not distant more than two miles. The summit peaks which surround it range in height from about 800 feet on the east side to about 1000 feet on the west of the broad undulated heathery hollow down which the stream flows in a mainly southern direction. The principal dale bears the name of Harwood dale. Opposite Cloughton is the escarpment towards the north of the tabular calcareous range of hills, which attains a height of 633 feet in Suffield Moor and 714 feet in Hackness Moor. This mass of hill is penetrated by numerous digitated glens, with steep wooded embankments. Beneath the western edge of the escarpment of Hackness Moor the stream flows beneath Barns Cliff down sylvan Langdale, its opposite bank guarded by a narrow calcareous ridge, which bears the name of Langdale Rigg. At the bottom of Langdale it receives a considerable affluent from the arenaceous moors on the north-west, which runs for several miles at the foot of the calcareous escarpment, which from Hackness moor sweeps round towards the west ; and here also it is joined by two smaller streams from the recesses of the same limestone hill, the glens of which are called Deep Dale and Trouts Dale. With calcareous hills rising steeply above it upon both sides, it flows past the village of Hackness, and down the beautiful thickly-wooded glen called Forge Valley, through the main mass of the calcareous range into the Vale of

Pickering. The following are the rarer plants of the wooded glens and banks of limestone in the neighbourhood of Hackness:

Helleborus viridis
Aquilegia vulgaris
Actæa spicata
Corydalis claviculata
Fumaria parviflora
Viola lutea
Sagina subulata
Hypericum montanum
Astragalus Hypoglottis
Onobrychis sativa
Vicia sylvatica
Spiræa Filipendula
Rubus saxatilis
Cornus suecica
Picris hieracioides
Hieracium cæsium
Silybum Marianum
Carduus eriophorus
Vaccinium Oxycoccus
Pyrola rotundifolia
„ *media*
Atropa Belladonna
Lathræa squamaria
Calamintha Acinos
Samolus Valerandi
Myrica Gale
Spiranthes autumnalis
Neottia Nidus-avis
Epipactis ensifolia
Orchis pyramidalis
Ophrys apifera
„ *muscifera*
Narcissus pseudo-narcissus
Convallaria bifolia
„ *majalis*
Carex pauciflora
„ *teretiuscula*
„ *pendula*
„ *lævigata*
„ *digitata*
Lastrea Fœnisecii
Osmunda regalis
Equisetum hyemale

Campylostelium saxicola
Trichostomum tophaceum
Ulota Drummondii
„ *phyllantha*
Tetrodontium Brownianum.

Through the Vale of Pickering the course of the Derwent is almost due west. At the point where it turns in a western direction, a small stream joins it from the east, which is called the Hertford river, and which rises not far from the coast near Filey, and flows for about five miles through low marshy ground down the hollow between the Chalk and the Limestone. West of Forge Valley are three small wooded glens in the limestone range, which are called Yedmandale, Bee Dale, and Sawdon Dale. The next dale to the main dale of Derwent which penetrates through the southern to the northern range of hills is called Newton Dale. The head of this dale joins the head of Goathland Dale, and the Whitby and Pickering railway runs along the depression which is thus obtained, from Pickering up Newton Dale, over the watershed ridge, which at this point is under 200

yards in elevation, and then down Goathland Dale in the direction of Whitby. Newton Dale at its upper part is a steep, narrow, heathery gill, its sides crested in some places with edges of arenaceous crag. On the east of it Lilla Howe Cross attains 1000 feet, and west of it several of the arenaceous peaks are between 800 and 900 feet in elevation. The calcareous range of hills is considerably broader between Hackness and Newton Dale than it is a little further westward, and the highest part of its table-land is here 882 feet above the sea-level. A small branch glen which is deeply excavated in this plateau, and which is called the Hole of Horcum, is well known to botanists as a station for *Cornus suecica*, a Montane plant, which south of the Scotch Highlands, is known only in this tract and amongst the Cheviots. The town of Pickering stands upon the banks of the Newton Dale stream, just where it leaves the limestone. A copious spring, at a place called Keld Head, situated on the edge of the limestone, west of Pickering, furnishes the source of the Costa, which flows southward through the valley and joins the Pickering stream and the Rye not far from where the latter falls into the Derwent. And east of Newton Dale and the Hole of Horcum is a glen called Thornton Dale, which, like the Hole of Horcum, does not penetrate beyond the Limestone; and the stream of which flows into the Derwent before the Rye reaches it. Besides the *Cornus*, the following are the more interesting plants of Newton Dale and the neighbourhood of Pickering :

Trollius europæus
Aquilegia vulgaris
Corydalis claviculata
Astragalus hypoglottis
Rubus calvatus
Hieracium cæsium
Carduus eriophorus
„ *heterophyllus*
Inula Helenium
Salvia Verbenaca
Marrubium vulgare
Myrica Gale
Neottia Nidus-avis
Orchis pyramidalis
Habenaria albida
Ophrys muscifera
Gagea lutea
Convallaria majalis
Potamogeton rufescens

Gymnostomum curvirostrum
Cynodontium Bruntoni
Dicranum fuscescens
Tetrodontium Brownianum
Polytrichum gracile
Bryum uliginosum
Cylindrothecium concinnum.

The next three considerable dales of the arenaceous hills, Rose Dale, Farn Dale, and Brants Dale, all penetrate the moorland mass to the high anticlinal ridge which runs from Burton Head eastward to the Peak cliff. The summits amongst which they take their rise, proceeding along the ridge from east to west, are as follows: Wheeldale Howe, 1043 feet; Shunner Howe, 1212 feet; Loose Howe, 1419 feet; Ralph Cross, 1409 feet; Westerdale Moor, 1422 feet; and Burton Head, 1489 feet; and digitations of hill which attain the Middle Zone stretch out for several miles southward between the dales. Of the three, Rose Dale is the broadest and most populous, Brants Dale the least so. In Rose Dale the ironstone of the Lower Oolite is now extensively quarried. It is conveyed to the Cleveland blast-furnaces by a line of railway which runs across the top of the moor from the mines to the head of the southern fork of the Leven. The streams of the three dales are called the Seven, the Dove, and the Bran. Each of them runs in a distinct dale through the calcareous range, which everywhere presents towards the north a steep escarpment, and is here not more than from two to four miles in breadth from north to south. The town of Kirkby Moorside is situated upon the southern edge of the limestone not far from the Farn Dale stream. Kirk Dale, celebrated for its cavern, is the lower part of the dale of the Bran where it breaks through the calcareous hills. Higher up this is called Sleightholme Dale, and nowhere in the district have we a finer sweep of aboriginal wood than extends along the slopes of this stream, whilst from Sleightholme Dale round the escarpment towards the north as far westward as Bilsdale stretches a continuous belt of larch plantations. From the Vale of Pickering the view up any of these wooded hollows of the wide extent of bleak moorland is very fine. Next comes Riccaldale, which does not penetrate far north of the calcareous range. The main stream of Rye rises amongst the northern moorlands, at a very short distance from the high escarpment which overlooks the Cleveland valley, and a western branch rises not far from the escarpment which over-

looks the great Central Vale. Bilsdale is a fine deep dale with high peaks between the ramified glens which branch from it at its northern extremity, and has its sides crested in some places by edges of freestone. Snilesworth, the western glen, is a broad, much branched, undulated hollow, which is separated only by a high ridge from the low country which sweeps round the edge of this moorland tract. Between Snilesworth and Bilsdale there is a narrow heathery glen, which is called Ladhill gill; and at Hawnby the three streams unite together to form the main branch of the Rye. The following are the more interesting plants of these three last-mentioned dales:

Barbarea intermedia
Rubus plicatus
„ *thyrsoideus*
„ *mucronatus*
„ *Bloxami*
„ *hirtus*
„ *rosaceus*
Epilobium angustifolium
Vaccinium Oxycoccus
Juniperus communis
Eriophorum latifolium
Allosorus crispus

Dicranum fuscescens
Didymodon flexifolius
Hedwigia ciliata
Grimmia trichophylla
Ptychomitrium polyphyllum
Orthotrichum rivulare
Tetrodontium Brownianum
Polytrichum commune var. *fastigiatum*
Mnium stellare
Fissidens pusillus
Heterocladium heteropterum
Hypnum ochraceum
Hyocomium flagellare
Fontinalis squamosa.

Opposite the bottom of Bilsdale on the east and due north of Helmsley, the calcareous range attains 1078 feet. From Helmsley in this direction runs up the pleasant sylvan glen which is described in detail at page 58. From the point where its three branches unite together, which is just ten miles distant from the head of Bilsdale, the Rye flows in a southern direction down a steep-banked, thickly-wooded dale, through the calcareous range, past Rievaulx Abbey, and beneath Duncombe Park and Lord Feversham's woods and hall to Helmsley, where it enters the Vale of Pickering. The view from the Terrace at Rievaulx of the ruins of the choir and refectory of the fine old Cistercian abbey, and the cottages which surround it, and the branching

calcareous glens with thick woods upon their slopes, and bright green meadows by the side of the streams beneath, and of the heathery table-land of the Hambleton hills beyond, is well worth a climb to see; and, although the height of the stand-point is little above two hundred yards, yet the steepness of the hill-banks gives the scene a well-marked montane aspect. The southern portion of the space between the three branch dales of Rye is occupied by two outlying elephant-shaped nabs of limestone, of which that on the east, which is called Easterside, attains a height of 1048 feet. On the slope of the other is placed the picturesque little village of Hawnby, a centre from which, in each direction, long lines of steep sylvan hill-banks radiate. From Hawnby the escarpment of the calcareous range sweeps round towards the north-west in the direction of Arden and Hambleton End. From north to south the Hambleton hills are about ten miles in length, the ridge of watershed, which from north to south sinks from nearly 1300 to 950 feet, being only a very short distance from their western edge, and the slope from it in the direction of the hills which overhang the Rye being very gradual. Several glens branch from the Rye in a western direction to penetrate these hills, lonely little dales crested with rock at their upper parts, and lower down their embankments, like those of the main dale of Rye, covered with wood. The principal of these branch glens are called Ardendale, Yowlass Dale, Nettle Dale, and Flazendale, and in a smaller one at Rainton Heights, near Hawnby, there is a fine precipice of Calcareous Gritstone, about fifty feet in depth. Opposite Hood Hill the line which bounds the hill-country turns abruptly towards the east, and there is now a steep embankment crested with limestone which faces the south, and is continued past Ampleforth (749 feet), and Oswaldkirk (544 feet), sloping gradually in an eastern direction till it sinks into the Vale of Pickering. The following are the rarer plants of the woods and branching glens of the neighbourhood of Hawnby and Helmsley:

Trollius europæus
Helleborus viridis
Aquilegia vulgaris
Actæa spicata
Draba brachycarpa
Stellaria nemorum
Tilia parvifolia
Hypericum montanum
Geranium sanguineum
Euonymus europæus
Spiræa Filipendula
Potentilla verna
Rubus saxatilis
„ *mucronatus*
Rosa Sabini
Epilobium angustifolium
Ribes alpinum
Sambucus Ebulus
Picris hieracioides
Hieracium murorum
„ *cæsium*
„ *tridentatum*
Carduus eriophorus
„ *acaulis*
Inula Helenium
Jasione montana
Atropa Belladonna
Euphrasia rigidula
Lathræa squamaria
Salvia Verbenaca
Mentha sylvestris
Calamintha officinalis
Lamium Galeobdolon
Lithospermum officinale
Primula farinosa
Salix nigricans
Spiranthes autumnalis
Neottia nidus-avis
Epipactis ensifolia
Orchis pyramidalis
Habenaria albida
Ophrys apifera
„ *muscifera*
Cypripedium Calceolus
Iris fœtidissima
Convallaria majalis
Schœnus nigricans
Eriophorum latifolium
Carex digitata
Melica nutans
Hordeum sylvaticum

Dicranum fuscescens
Ulota Hutchinsiæ
Pogonatum alpinum
Leptobryum pyriforme
Bryum obconicum
Mnium stellare
Philonotis calcarea
Camptothecium nitens
Brachythecium glareosum
Hypnum filicinum var. *vallisclausæ*
Rhynchostegium depressum
Cryphæa heteromalla.

From Helmsley through the Vale of Pickering the Rye flows in a south-eastern direction towards the Derwent. Seven miles from Helmsley it receives the united Brantsdale and Farndale streams; in three miles more that from Rosedale; and not far from its union with the Derwent the Costa joins it. From the point where the Rye joins it, the Derwent flows towards the south-west, till it becomes upon both sides a river of the East Riding. Upon the bank and in the neighbourhood of the river, from the junction downwards past Malton, several interesting

Hygrophilous plants are to be met with, of which the following are the most noteworthy:

Nymphæa alba	*Butomus umbellatus*
Ranunculus Lingua	*Potamogeton flabellatus*
Sium latifolium	,, *gramineus*
Cicuta virosa	,, *lucens*
Œnanthe crocata	*Lemna polyrrhiza*
Hydrocharis Morsus-ranæ	*Acorus Calamus*
Sagittaria sagittifolia	*Rumex Hydrolapathum.*

The Howardian tract is separated on the north-west from the range of the calcareous hills over Ampleforth and Oswaldkirk by the hollow along which runs the Thirsk and Malton Railway. The southern of its two terraces, that which is composed of sandstone, is during part of its course the watershed between Foss and Derwent. Beginning at the north-western extremity, we have the park and hall of Newburgh upon its slope towards the railway, and the moors of Yearsley and Oulston upon the summit of the ridge, which, at this point, is nearly 600 feet in elevation. A few miles further east are the park of Wiganthorp, and the moor of Scackleton, below which rises a stream which flows on the south side of the ridge past the villages of Bulmer and Foston-le-Clay to the Derwent. Mowthorpe Dale is a small wooded glen where a branch of this stream penetrates the ridge. Then comes the village of Terrington and the woods and park and mansion of Castle Howard. The ridge at this point is not more than 300 feet in elevation, and it declines still more past Whitwell, Welburn and Crambeck, in the direction of the Derwent.

The northern of the two terraces, that which is composed of calcareous materials, runs parallel with the other, but is not continued so far westward. On the south it has a steep escarpment, which in many places is covered with wood, but on the north its slope towards the Vale of Pickering is more gradual. At Gilling the sylvan nab which forms the termination of the ridge in a western direction, stands out boldly against the hollow along which the railway runs. At Hovingham and Slingsby two streams

from the arenaceous terrace break through the limestone, and upon the slope of the ridge towards the north the two villages are situated. Wath Wood, Slingsby Wood, Coneysthorpe Wood, and Hildenley Wood, are all upon the escarpment of this ridge towards the south; and Terrington Carr, well known as a botanical locality, is a small heathery swamp, by the side of the Slingsby stream, in the trough between the two terraces. The town of Malton is situated upon the slope towards the Vale of Pickering of the calcareous ridge, upon the north bank of the Derwent. This Howardian tract furnishes a great variety of situation, and although it has none of the more decidedly Montane plants, yet we obtain here as many of the rarer species as are to be found anywhere in North Yorkshire within an equal area, with the exception of Upper Teesdale, as the following list of its productions may testify :

Myosurus minimus
Trollius europæus
Helleborus viridis
Aquilegia vulgaris
Actæa spicata
Papaver hybridum
Corydalis claviculata
Fumaria Vaillantii
Teesdalia nudicaulis
Drosera anglica
„ *intermedia*
Dianthus deltoides
Silene anglica
Arenaria tenuifolia
Stellaria nemorum
Radiola Millegrana
Hypericum montanum
„ *elodes*
Geranium sanguineum
Euonymus europæus
Rhamnus Frangula
Trifolium striatum
Astragalus glycyphyllos
„ *Hypoglottis*
Ornithopus perpusillus
Vicia sylvatica
Spiræa Filipendula
Rubus saxatilis
„ *plicatus*
„ *mucronatus*
„ *Sprengelii*
„ *Bellardi*
„ *hirtus*
Rosa Sabini
Epilobium angustifolium
Caucalis daucoides
Galium erectum
„ *tricorne*
Picris hieracioides
Lactuca virosa
Silybum Marianum
Carduus eriophorus
Erigeron acris
Inula Conyza
„ *Helenium*
Campanula glomerata
„ *Trachelium*
Specularia hybrida
Jasione montana
Vaccinium Oxycoccus
Gentiana Pneumonanthe
Atropa Belladonna

Linaria Elatine
Orobanche elatior
Lathræa squamaria
Salvia Verbenaca
Mentha Pulegium
Thymus Chamædrys
Calamintha Acinos
„ *officinalis*
Lithospermum officinale
Plantago Coronopus
Spiranthes autumnalis
Neottia Nidus-avis
Epipactis ensifolia
Orchis pyramidalis
Ophrys apifera
„ *muscifera*
Gagea lutea
Convallaria majalis
Potamogeton rufescens
Rhynchospora alba
Scirpus multicaulis
„ *acicularis*
Carex divulsa
„ *teretiuscula*
„ *limosa*
„ *pseudo-cyperus*
Arundo Calamagrostis
„ *Epigejos*
Melica nutans
Festuca pseudo-myurus
Bromus erectus
Brachypodium pinnatum
Hordeum sylvaticum
Lastræa Thelypteris
Lycopodium inundatum
Equisetum hyemale

Sphagnum laricinum
Microbryum Floerkeanum
Phascum bryoides
Physcomitrella patens
Pleuridium alternifolium
Gymnostomum tenue
„ *microstomum*
Seligeria pusilla
„ *Doniana*
Brachyodus trichodes
Dicranella Schreberi
„ *rufescens*
Dicranum spurium
Trichodon cylindricus
Trichostomum tophaceum
Ditrichum tortile
Barbula ambigua
„ *rigida*
„ *aloides*
„ *marginata*
„ *papillosa*
Bryum uliginosum
„ *turbinatum*
„ *obconicum*
Mnium stellare
„ *riparium*
Paludella squarrosa
Philonotis calcarea
Bartramia ithyphylla
Sphlachnum ampullaceum
Fissidens pusillus
„ *crassipes*
Cylindrothecium concinnum
Camptothecium nitens
Eurhynchium crassinervium
„ *pumilum*
Rhynchostegium tenellum
„ *depressum*
Hypnum elodes
„ *stramineum*
„ *Crista-castrensis*
Thuidium Blandovii
Neckera pumila
Cryphæa heteromalla.

West of the Bulmer stream there is an outlying wooded hill capped with Lower Oolite, at Stittenham, but it is under 300 feet in height. A narrow tract of Lias occupies the slope in the

direction of the Central Valley of the southern Howardian terrace. In the Central Valley the Derwent flows due south till it leaves the Riding. Buttercrambe Moor is a low wooded heath, of the same kind as several which come within the district drained by the Foss. Here grow *Carduus pratensis*, *Cladium Mariscus*, *Polypodium Phegopteris*, and *Lastræa Thelypteris*. At Stamford Bridge the river enters the East Riding.

This is considerably the largest drainage district of the nine, and has considerably the largest flora. In Montane plants it is above all the other districts of the eastern subprovince, but below each of the three hilly districts of the west. For Xerophilous plants it is on a par with the Yore and West Swale districts, and amongst the thick woods and grassy banks of its calcareous hills many of the more interesting plants of this category grow plentifully. In Maritime plants it is not rich, especially when the length of its coast-line is considered. The Vale of Pickering furnishes a large number of Hygrophilous species, and for Rarer Ascending plants this district stands highest of the nine.

GEOGRAPHICAL ANALYSIS
OF THE FLORA OF THE DERWENT DISTRICT.
AREA 515 SQUARE MILES.

CATEGORY.	Number of Species.	Per Centage of total native flora.
1 Montane Species	40	5
2 Xerophilous ,, ...	47	6
3 Maritime ,, ...	20	3
4 Hygrophilous ,, ...	65	9
5 General Ascending Species	362	49
6 Scattered Ascending ,,	166	23
7 Local Ascending ,,	34	5
8 Colonists	70	
9 Denizens	22	
Total number of species.	827	

THE EAST SWALE DISTRICT (No. 2).

This district, like that of East Tees, consists of an edge of the eastern moorlands, a tract of undulated country underlaid by liassic strata which sweeps round their base, and beyond the Lias about one-half of its total area is comprised in the great Central Valley ; but in this case the line of the embankment of the moorlands runs north and south, and this district, unlike that of East Tees, has no coast line. Here, also, as in East Tees, the watershed is only a very short distance from the edge of the hill, and no dales of any considerable size which belong to the district penetrate to the moorland mass, and the slope from a height of 900 or 1,000 down to 300 feet is very sudden.

The western boundary of the district is formed by the Wiske till it joins the Swale, and afterwards by the latter river. The less elevated part of the district is often called the Vale of Mowbray. The Mowbray family were its ancient feudal lords, and the district as here defined is almost identical with the tract to which Mr. Grainge's book, which bears the title of "The Vale of Mowbray," refers. The principal stream which runs through it is called Codbeck. The hills which form its watershed on the east are the two ranges which run through the Derwent district from west to east, and terminate against the sea coast, as has just been explained.

First, we will take the hill embankment, and afterwards the low country. The Codbeck and the Wiske both rise in the same glen, which is situated at the north-west corner of the great mass of the hills. This glen is called Scarth Nick, and is a bare, bleak, treeless hollow, with the Wiske issuing from it at the north end, and Codbeck in an opposite direction. On the west of this glen is a steep, narrow ridge, on the slope of which, towards the low country, are the woods of Arncliffe and the ruins of the priory of Mount Grace. The moors above

Osmotherley are lower both than the arenaceous hills further west, and the calcareous range on the south. They are much undulated by the heathery glens in which run the branches of Codbeck and the Rye, the summit of the watershed ridge being here 1,048 feet above the sea-level. Above Silton a spur of the arenaceous range stands out into the low country, and behind it is Black Hambleton (1289 feet), which is at once the highest point, and the termination in a western direction of the escarpment towards the north of the calcareous range. Opposite Kepwick and behind a round outlying mass of hill, called Kepwick Nab, is a bleak, undulated hollow, shut in by moors upon three sides, in which a branch of Codbeck takes its rise. Above Kirkby Knowle and Boltby another spur of arenaceous hill spreads out westward and south-westward from the main range. Above Kirkby Knowle this moor is 880 feet in height, and has a craggy crest, and a little tarn in a hollow, formed by a landslip, upon its slope. In front of Boltby the moor is somewhat higher, and has a steep embankment, covered with fir plantations; and the escarpment, still capped with Lower Oolite, but much lower than Boltby Moor in elevation, is continued still further in a south-western direction, as far as Feliskirk and Mount Saint John, from which point it declines gradually into the low country. The main body of this rounded spur of hill is called Black Moor, from which on the north-west Wool Moor or Knayton Moor is separated only by a narrow glen. In the hollow between Black Moor and the main range another branch of Codbeck takes its rise, the two branch glens of which open out at the village of Boltby. The western of these is the most interesting—a deep, boggy, heathery, and wooded hollow, called Gurtof Gill, to which in times past the Thirsk naturalists have often resorted for mosses, and Oak and Beech Fern.

Above Kepwick and Black Moor the calcareous table-land reaches a height of from 1,100 to 1,200 feet. From Boltby to where opposite Hood Hill it turns abruptly due east the continuity of the hill-bank is unbroken. The distance in a direct

line is about four miles, but it is much more if the windings of the edge of the embankment are followed. This portion of the great calcareous range is called the Hambleton Hills. In elevation it declines gradually from north to south from 1,100 to 950 feet, but the embankment is so steep that these hills as viewed from Thirsk look much higher than they are in reality. The Calcareous Gritstone which crests the embankment forms fine precipices at three places—one above Boltby, the second opposite Thirsk, and the third at the southern extremity of the escarpment. These are called Boltby Scar, Whitestone Cliff, and Roulston Scar. Whitestone Cliff especially is a noble crag. It measures fully one hundred feet in sheer perpendicular depth, and beneath it, as at Boltby and Roulston, the embankment slopes steeply for 500 feet, and is thickly strewn with fallen fragments of the summit-cliff. At the foot of this slope we have the only considerable tarn of these East Yorkshire hills. It is called Gormire, and is about three-quarters of a mile in circumference, with, on the east, the embankment of the main mass of hill rising steeply from its shore, and on the other three sides a high ridge of arenaceous hill sweeping round it. There are no streams except the mere runnels of the hill-bank which flow into it, and none flow from it; so that its waters are mainly supplied by rain, and diminished by evaporation. From the summit of Whitestone Cliff the view upon a clear day is very fine and extensive.* Immediately beneath is the precipice and the lake,

* This is the locality of the following sonnet of Wordsworth's:

'Dark and more dark the shades of evening fell;
The wished-for point was reach'd, but late the hour,
And little could be gained from all that dower
Of prospect, whereof many thousands tell;
Yet did the glowing West in all its power
Salute us:—there stood Indian citadel,
Temple of Greece, and Minster with its tower
Substantially expressed, a place for bell
Or clock to toll from.—Many a tempting isle,
With groves that never were imagined lay
Midst seas how steadfast! object for the eye
Of silent rapture: but we felt the while
We should forget them: they are of the sky,
And from our earthly memory fade away.'

and the steep embankment, covered with thickets of Brake and Blackthorn and thickly strewn with fallen piles, confusedly upheaped, of massive and angular rocks. From Boltby Moor southward to Hood Hill a pleasant undulated wooded tract extends, and beyond the broad central valley is spread out like a map from the Tees southward as far as York, with Thirsk and Ripon marked conspicuously, and the lines of railway easily traceable by the smoke of passing and repassing trains. And beyond stretch the western moors, the huge bulk of Penhill looming in front to shut in Wensleydale like a barrier, and the higher Great Whernside peak, on the south of it, for a focus from which the undulated lines of hill stretch north and south till they are lost to view in misty distance. The following are the rarer plants of Gormire, and of the hill embankment from Scarth Nick southward to Roulston Scar :

Trollius europæus
Draba inflata
Viola lutea
Stellaria nemorum
Geranium sanguineum
Rubus Bakeri
,, *calvatus*
,, *mucronatus*
,, *Bloxami*
Epilobium ligulatum
Peplis Portula
Hieracium murorum
,, *cæsium*
Lathræa squamaria
Primula farinosa
Trientalis europæa
Lysimachia thyrsiflora
Gagea lutea
Potamogeton lucens
,, *heterophyllus*
Acorus Calamus
Festuca bromoides
Lycopodium selaginoides
Pilularia globulifera

Brachyodus trichodes
Seligeria Doniana
Dicranum fuscescens
Barbula aloides
,, *marginata*
Hedwigia ciliata
Grimmia trichophylla
Tetrodontium Brownianum
Orthotrichum stramineum
Ulota Hutchinsiæ
Bryum pendulum
,, *torquescens*
,, *obconicum*
Mnium affine
,, *cuspidatum*
Tetraplodon mnioides
Philonotis calcarea
Fissidens pusillus
Eurhynchium crassinervium
Eurhynchium pumilum
Rhynchostegium tenellum
,, *depressum*
Heterocladium heteropterum
Hypnum giganteum
,, *pratense*
Hylocomium brevirostrum
Hyocomium flagellare.

Opposite the south-western corner of the calcareous range is an outlying nab, capped with limestone, which is called Hood Hill, and which is nearly as high as the adjacent part of the main mass of moorland. Upon three sides it has an abrupt wood-covered slope, and in a southern direction declines more gradually. The escarpment of the calcareous range towards the south, from Roulston Scar westward over Kilburn and Coxwold, is almost as abrupt as the slope which faces west. This portion of the calcareous plateau is between 800 and 900 feet, and the bank is mostly covered with woods. A small branch of the Swale takes its rise upon this embankment, but its glens do not penetrate far into the recesses of the hill-country. Cockerdale is a pleasant wooded rocky hollow, and two other branches of the same stream rise, one of them in Wass Woods, and the other upon the southern slope of Hood Hill. The ruins of Byland Abbey stand in the low ground at the foot of Wass Bank, and the extremity of the arenaceous Howardian terrace forms here the watershed of this district upon the south-east. The hall and fish-pond of Newburgh are pleasantly situated in the midst of an extensive park upon the slope of the terrace in this direction, and still further west upon the same slope is the village of Husthwaite, and above it the arenaceous crag of Beacon Bank. The following are the rarer plants of the neighbourhood of Coxwold :

Ranunculus circinatus
„ *Lingua*
Arabis hirsuta
Stellaria nemorum
Radiola Millegrana
Hypericum montanum
Scrophularia vernalis
Lathræa squamaria
Mentha sylvestris
Calamintha officinalis
Salix nigricans
Arundo Calamagrostis
Brachypodium pinnatum

Brachyodus trichodes
Seligeria Doniana
Barbula marginata
Mnium cuspidatum
Philonotis calcarea
Fissidens pusillus
Eurhynchium crassinervium
Eurhynchium pumilum
Hyocomium flagellare
Rhynchostegium depressum.

We must now bid farewell to the hill-bank and turn to the low-country. Of all the streams of North Yorkshire the Wiske is the most sluggish, and has the least deeply-excavated stream channel. It usually is more like a broad ditch than a typical North Yorkshire rivulet. From Scarth Nick its course is at first north-west, and afterwards due west through the low country for ten miles, and then it turns abruptly to the south, and runs for fifteen miles in that direction before it joins the Swale. Upon the banks of a small branch of the Wiske, not far from the eastern edge of the Central Valley, stands the town of Northallerton, the central town of the North Riding, and the place where its sessions are held, and its gaol is situated. This town is about six miles distant from the nearest point of the hills, and in its neighbourhood, within the bounds of this drainage district, the following plants occur :

Ranunculus Lingua
,, *parviflorus*
Helleborus fœtidus
Fumaria pallidiflora
Alyssum calycinum
Nasturtium sylvestre
Viola hirta
Saponaria officinalis
Cerastium aquaticum
Radiola Millegrana
Vicia sylvatica
Rubus plicatus
Myriophyllum verticillatum
Smyrnium Olusatrum
Cuscuta Epilinum
Linaria minor
Veronica polita grandiflora
,, *Buxbaumii*
Orobanche minor
Polygonum minus
Sagittaria sagittifolia
Butomus umbellatus
Hydrocharis Morsus-ranæ.

A small piece of boggy ground situated not far from the junction of the Wiske with the Swale, and called Newsham Carr, still remaining in an aboriginal condition, yields the following plants:

Ranunculus Lingua
Cicuta virosa
Rumex Hydrolapathum
Lemna polyrrhiza
Carex teretiuscula
,, *stricta.*

The course of Codbeck, from the Osmotherley end of Scarth Nick until it joins the Swale, is south-westward through, or not far from, the undulated liassic tract which margins the hill-country, the total length of the stream being about twenty-five

miles. Opposite Northallerton it is margined on the east by the woods of Cotcliffe, which extend for about two miles along the slope of a bank of the liassic shale, the summit of which is about 400 feet in height above the stream, and at the south end of this bank the sandstone of the Lower Oolite just shews itself. A considerable slip of land has taken place here, a part of the wood having glided down so gradually that the trees and brushwood which compose it are not destroyed: and over the site of what a quarter of a century ago was a grassy meadow by the side of the stream, there is now a steep, broken, wood-covered, clayey bank. We have here an instance, upon a small scale, of the same kind of land-slip that has occurred at Kirkby Knowle upon a much larger scale within the memory of man, and upon a much larger scale still at Gormire, at a period which is perhaps as far back as the great glacial inundation. At Brawith, Codbeck is increased by the stream which rises near Kepwick, and soon afterwards it is joined by a rivulet from Kirkby Knowle and Mount Saint John. The town of Thirsk is situated upon the banks of Codbeck, upon the eastern edge of the Central Valley and at a distance of five miles due west of Whitestone Cliff. Upon the east of the town the liassic slope attains 200 feet within a mile of it, and this altitude of surface is almost or quite maintained till the foot of the hill-bank is reached. The Boltby stream flows in a south-western direction past Sutton-under-Whitestone Cliff and Bagby, and falls into Codbeck near Gristhwaite, and soon afterwards the latter pours its waters into the Swale. The following are the more interesting plants of the low country in the neighbourhood of Thirsk:

Myosurus minimus
Ranunculus floribundus
„ *fluitans*
Ranunculus hirsutus
Fumaria pallidiflora
Alyssum calycinum
Turritis glabra
Nasturtium sylvestre
Sinapis tenuifolia
Viola peregrina
Saponaria officinalis
Silene anglica
Cerastium aquaticum
Stellaria brachypetala
Radiola Millegrana
Geranium pyrenaicum
Rubus plicatus
„ *thyrsoideus*

Rubus Sprengelii
„ *mucronatus*
„ *altheifolius*
Rosa Sabini
„ *rubiginosa*
„ *tomentella*
Epilobium roseum
Ribes alpinum
Sedum Telephium
Torilis infesta
Galium insubricum
„ *tricorne*
Fedia Auricula
Lactuca virosa
Hieracium tridentatum
Erigeron acris
Specularia hybrida
Jasione montana
Gentiana Pneumonanthe
Chlora perfoliata
Cuscuta europæa
„ *Trifolii*
Atropa Belladonna
Orobanche minor
Mentha viridis
Calamintha Acinos
„ *officinalis*
Marrubium vulgare
Lithospermum officinale
Primula farinosa
Lysimachia thyrsiflora
Chenopodium glaucum
Atriplex deltoidea
Polygonum laxum
„ *mite*
Rumex aquaticus
Salix rubra
Orchis ustulata
Allium oleraceum
„ *Scorodoprasum*
Colchicum autumnale
Typha angustifolia
Juncus diffusus
„ *obtusiflorus*
Apera Spica-venti
Arundo Epigejos
Equisetum hyemale

Gymnostomum tenue
Barbula aloides
„ *latifolia*
„ *papillosa*
Ptychomitrium polyphyllum
Orthotrichum tenellum
„ *rivulare*
„ *Sprucei*
Leptobryum pyriforme
Bryum obconicum
Mnium affine
Fissidens crassipes
Eurhynchium speciosum
„ *Teesdalii*
Hypnum polygamum
„ *aduncum* v. *Kneiffii*
„ *pratense*
Cryphæa heteromalla.

The Coxwold stream runs in a south-western direction past Husthwaite and Birdforth, and falls into the Swale a short distance below the mouth of Codbeck.

In this district the Middle Oolite forms the surface of the Hambleton plateau from Black Hambleton southward to the escarpment over Coxwold and Wass, and is also the cap-rock of Hood Hill. At Whitestone Cliff the series is 200 feet in thickness, the Coralline Oolite forming the summit of the table-land, the Lower Calcareous Gritstone the great cliff, and the Kelloways

Sandstone the ferruginous crags, which are exposed at from 50 to 100 feet below it, at the summit of the steep sandy slope. The Lower Oolite forms the surface of Osmotherley Moors, and sinks beneath the calcareous range, to reappear on the south of it. At Whitestone Cliff the summit of this series is 850 feet above the sea-level, and its thickness 600 feet. In the Coxwold hollow it occupies the low ground and the summit of the ridge on the south, and a spur stretches out westward in the direction of Carlton Husthwaite and Thirkleby. The calcareous band is worked for lime in several places. The Upper Lias Shale was formerly worked for Alum and Jet at Thimbleby, and has recently been worked for Jet in Cotcliffe wood.

For Montane plants this is the second of the four hilly districts of the east. It has only a mere edge of limestone hill, and in Xerophilous species is not rich, nor are those which do occur plentiful. The low grounds from Thirsk and Northallerton westward to the Wiske and Swale produce a considerable number of Hygrophilous species, especially the vicinity of the first-mentioned stream; and for Rarer Ascending species this district is only below the more extensive districts of West Swale and Derwent.

GEOGRAPHICAL ANALYSIS OF THE FLORA OF THE EAST SWALE DISTRICT. AREA 170 SQUARE MILES.

CATEGORY.	Number of species.	Per centage of total native flora.
1 Montane Species	23	4
2 Xerophilous ,, ...	23	4
3 Maritime ,, ...	0	0
4 Hygrophilous ,, ...	54	8
5 General Ascending Species	362	57
6 Scattered Ascending ,,	159	25
7 Local Ascending ,,	15	2
8 Colonists	70	
9 Denizens	24	
Total number of the species	730	

THE OUSE & FOSS DISTRICT (No. 1).

This district and the Ainsty are the only two of our nine drainage districts which do not include within their limits any hills of the Middle Zone, and this district, next to the Ainsty, is the smallest of the nine. The greater part of it was included in the royal forest of Galtres, which was kept for the purpose of a royal hunting ground almost in an aboriginal state from the time of the Saxons down to the year 1670, when an act of parliament was obtained, and the forest broken up and enclosed. Only a small portion of the watershed of the district on the north-east is above one hundred yards in elevation, and fully one-half of its surface is within one hundred feet of the sea-level.

The Ouse, which is now a river of large size, forms the boundary of the district on the south-west, and the Foss and a smaller stream called the Kyle run through it from the north-east in that direction. Both these two latter take their rise upon the slope of the arenaceous Howardian terrace at its highest end, which is the point of watershed between Foss, Swale, and Derwent. The wooded slope of the terrace at Yearsley, and the steep wooded glen at the bottom of which are the Foss reservoirs, and the uncultivated heaths of the upper part of the ridge above them have something of a montane aspect; and from an elevation of nearly 200 yards on Yearsley moor there is a fine view down the glen to the Wolds in the distance, and towards the south-west of the ridge upon which Crayke Castle stands, and the wide sweep of low country, in the direction of York, beyond it. The following are the more interesting plants which grow here :

Ranunculus floribundus
Teesdalia nudicaulis
Cerastium semidecandrum
Spergularia rubra
Sedum Telephium
Filago minima
Plantago Coronopus
Potamogeton heterophyllus
Carex fulva
Didymodon flexifolius

A broad surface of undulated clayey country, underlaid by Lias, sweeps round the south-west of the terrace. Through this tract both the streams flow during the early part of their course, and out of it rises the hill of Crayke Castle (400 feet), which, like the terrace, is capped with Oolitic Sandstone. In the midst of the liassic tract, about midway between the two streams, the town of Easingwold is situated, and it includes several villages of considerable size. The south-western half of the district belongs to the Central Valley, and is populated but thinly. The soil is principally sandy, and there are several carrs, and plantations of fir-trees and tracts of uncultivated, boggy heather-land. Of these last, Pilmoor, by the side of the railway, upon the edge of the district which is nearest the Swale, and the commons or 'forests' of Stockton and Strensall are the principal. Strensall Common is now drained and turned into a military camp, the Aldershot of the North. The following are the rarer plants which grow upon these two last-mentioned heaths, along with several mosses and other plants which are rare in the Central Valley:

Drosera intermedia
Spergularia rubra
Cerastium semidecandrum
Radiola Millegrana
Hypericum elodes
Trifolium striatum
Ornithopus perpusillus
Epilobium angustifolium
Peplis Portula
Carduus pratensis
Filago minima
Jasione montana
Andromeda polifolia
Gentiana Pneumonanthe
Cuscuta Epithymum
Mentha Pulegium
Lemna polyrrhiza
Scirpus acicularis
Arundo Calamagrostis
Lycopodium Selago
„ *selaginoides*
„ *inundatum*
Pilularia globulifera
Equisetum hyemale

Archidium phascoides
Dicranum spurium
Ceratodon cylindricus
Campylopus brevipilus
Bryum annotinum
„ *sanguineum*
Bartramia arcuata
Physcomitrium fasciculare
Hypnum elodes
„ *scorpioides*
„ *lycopodioides.*

In its course through the central valley portion of the district the Foss is a slowly-flowing stream with low banks, much

resembling the Wiske in character, although considerably larger in size. The Wiske, the Foss, and the Derwent in its course through the Vale of Pickering, are the only typical valley streams which we have in North Yorkshire, and it is about these that the Hygrophilous plants principally cluster. The following are the rarer plants of what are called the Foss Islands, a small piece of boggy ground which is intersected by ditches, near the junction of the stream with the Ouse, and of the banks of the stream and its channel in the neighbourhood of York.

Nymphæa alba
Nasturtium sylvestre
Cerastium aquaticum
Myriophyllum verticillatum
Ceratophyllum demersum
Chenopodium urbicum
Polygonum minus
,, *mite*
Rumex palustris
Sagittaria sagittifolia
Butomus umbellatus
Potamogeton compressus
,, *lucens*
Lemna gibba
,, *polyrrhiza*
Sparganium minimum

Physcomitrella patens.

A large portion of the city of York is included in the angle between the Foss and the Ouse. The following are the rarer plants of the suburb of Clifton, and the fertile sandy alluvial meadows which margin the Ouse on the north-west of the city:

Fumaria Boræi
Barbarea stricta
,, *sylvestris*
Nasturtium sylvestre
Saponaria officinalis
Cerastium aquaticum
Epilobium roseum
Chenopodium olidum
,, *urbicum*
,, *murale*
Atriplex deltoidea
Rumex aquaticus
Orchis pyramidalis
Orchis ustulata
Colchicum autumnale
Potamogeton flabellatus
Carex pseudo-cyperus
Alopecurus bulbosus

Pottia Starkeana
Barbula latifolia
Orthotrichum pallens
,, *Sprucei*
,, *pumilum*
Myrinia pulvinata
Scleropodium cæspitosum.

This district has the smallest flora of the nine. The Montane and Xerophilous category are in it but nominally represented, and the Maritime category not at all. In the low grounds the Hygrophilous category is well represented. The clayey soils

of the Lias, and the sandy soils of the Central Valley, do not furnish a great variety of situation, and the number of its Rarer Ascending species is below the average of the districts.

GEOGRAPHICAL ANALYSIS OF
THE FLORA OF THE OUSE AND FOSS DISTRICT.
AREA 133 SQUARE MILES.

CATEGORY.	Number of species.	Per centage of total native flora.
1 Montane species	9	2
2 Xerophilous ,, ...	13	2
3 Maritime ,, ...	0	0
4 Hygrophilous	55	10
5 General Ascending species	362	64
6 Scattered ,, ,,	109	20
7 Local ,, ,,	16	2
8 Colonists	54	
9 Denizens	17	
Total number of species.	635	

TABULAR SUMMARY

OF NUMBER OF PLANTS OF

THE CONTRASTING GEOGRAPHICAL CATEGORIES

IN THE NINE DRAINAGE DISTRICTS.

The reader is requested to study the following table, which brings into comparison the number of species of the contrasting geographical categories which the different districts furnish, in connection with the paragraph at page 126.

DISTRICTS.	CATEGORIES.				
	Montane.	Xerophilous.	Maritime.	Hygrophilous.	Rarer. Ascending.
9 West Tees ...	77	35	1	15	98
8 West Swale...	52	45	1	62	167
7 Yore	58	49	2	37	126
6 Ainsty	7	34	0	55	119
5 East Tees ...	21	19	51	38	139
4 Esk	20	18	33	19	129
3 Derwent	40	47	20	65	200
2 East Swale ...	23	23	0	54	174
1 Ouse & Foss	9	13	0	55	125

INTRODUCTION

TO

THE FLORA.

INTRODUCTION

TO

THE FLORA.

Our knowledge in detail of the character and mode of operation of the agencies which have been employed to bring about the distribution of plants and animals over the surface of the earth, and thus to produce the condition of things which at the present time we behold, is very limited indeed. Which are true species, which aboriginally distinct, and which mere modifications of one common stock produced by the influence of mere change of circumstance, this point it is impossible for us to determine with certainty with regard to what appear to us now as truly distinct species, and are described as such in our handbooks. We cannot sail backward along the stream of time, and unravel the intricacies of their bygone genealogies. We are obliged, for practical purposes, to take them as we find them; to describe or receive as species all those associations of an indefinite number of plants and animals which we observe to possess in common what we agree to consider sufficiently well-marked permanent characteristics; the difference between the so-called analysts and synthesists of descriptive zoology and botany really amounting to no more than this, that whilst both are agreed in the theoretic idea that the individuals of a species should possess permanent characteristics in common, yet when it comes to the carrying out of the idea into practice, the latter insist upon more decidedly marked diagnostic characters, that is to say, upon broader lines of demarcation, than the former. And hence arises the fact, that species as described in books are often combinations of very unequal value, and that, especially

in what are called critical genera, such as *Rosa*, *Rubus*, *Hieracium*, *Salix*, and *Viola*, a series of forms which one author will include under a single species only, another author will subdivide and separate amongst a considerable number.

And as it is with our knowledge of the genealogy of species, so it is with our knowledge of the character and mode of operation of the agencies which have been employed to bring about their diffusion. Except in those cases where the spreading abroad of species has manifestly been effected by human agency, operating either in a direct or in an indirect manner, we are almost entirely in the dark as to how they have reached the places where we now see them. We cannot tell which are true aboriginal species. We cannot tell whether each true aboriginal species was in its original creation represented by a single individual, or a pair of individuals, or by an indefinite number of individuals, or pairs; neither, even if we choose to assume the latter to be the case, are we in a position to say to what extent the facts which relate to species-dispersion have been brought about at a period coincident with or posterior to the date of their original creation.

But although our ignorance is so great, and our chance of diminishing it so small, when in treating of the distribution of species we consider the active agencies by which their diffusion has been brought about, yet when we come to speak of the agencies which have operated to restrict their distribution the case is different. Each species, we can say with confidence, is plainly limited in its distribution by certain physical conditions; and if we seek out in detail what the physical conditions which accompany the distribution of a species are, we are placed in a position in which we can form something of an estimate as to which of those conditions have upon the distribution an essential bearing.

The Influence of Human Agency in Modifying a Flora.—In viewing the flora of any definite district, as we have it at the present time, it is needful, if we would wish to inquire respect-

ing its geographical relations, that we should in the first place observe carefully, and having observed, should bear in mind constantly, to what extent, and in what way human agency has been brought to bear upon it. In any long-settled, long-cultivated, tract of country, the modification which has been brought about by human agency is, of necessity, very considerable. Around the spot where man fixes his dwelling, swamps, moors and woods disappear, to make way for cultivated fields, roads and gardens; aboriginal species characteristically paludal, uliginal, ericetal, and sylvestral, become more or less restricted in their range, or are exterminated altogether; and the places which they occupied are filled up by the species which man cultivates, and the weeds which these bring in their train. Thus not only is the natural range of the plants indigenous to the country very much interfered with, but interspersed amongst them, and side by side with them, we see growing wild a host of importations more or less firmly settled down, the line between which and the genuine natives it is often very difficult to draw in detail with a firm hand.

In treating of the characteristics of our three climatic zones, indications have already been given of the heights up to which, in the country upon which we are engaged, the various manifestations and results of human agency interfere with and modify the natural condition of its surface. The Upper Zone remains almost in its aboriginal state. The Middle Zone has been comparatively little interfered with, and although a considerable part of it is enclosed, yet houses, cultivated fields, gardens and planted woods occupy only a very small proportion of the surface which it includes, and only a very small proportion of the introduced plants extend their range into its limits. But although in the Lower Zone a considerable extent of the surface still remains as heatherland, and a little as aboriginal woodland, yet in the remainder of this zone, and especially throughout the vales and low country, the case is very different; for not only do the fields where the cereal grasses, forage, potatoes and clover

are cultivated, and the road-sides, hedge-rows, and waste ground in the neighbourhood of towns, villages, farm-houses, gardens, and parks furnish a large number of these imported plants, but also the woods, the hedge-rows and the pastures are often plainly, and still oftener presumably, of artificial origin, even when yielding trees, shrubs, grasses and other plants, which elsewhere in the district evidently occupy their natural places of growth.

Excluding those which are probably or certainly extinct, and probably or certainly mis-reported, our list contains the names of upwards of 1150 species of Flowering Plants and Ferns, all of which have some sort of claim to be enumerated in a catalogue of the wild plants of North Yorkshire. Of these, 882 species appear to possess a more or less clear title to be regarded as aboriginal and genuine inhabitants of the Riding, and so far as we can judge from present appearances, it is these and these only that we must regard as composing its proper and natural flora. Out of the plants which grow wild with us at the present day, we must, if we wish to restrict our list to those to which Nature gives us a title, strike out one species in four as introduced. But a large number of these introductions are now very thoroughly settled down. It is easy to arrange nearly all of them under two categories, the species of which, in respect of the plenty and the places in which they grow, differ notably. These two categories are, first, importations by means of Agriculture ; and, second, importations by means of Horticulture ; and the only introduced species which do not range conveniently under either of these heads are about a score of ballast plants and two or three trees. Following the nomenclature of the Cybele, I have called the more frequent and more thoroughly established agricultural weeds by the name of Colonists, drawing the line between them and the Natives so as to exclude from the Native list those species which scarcely occur except in cultivated fields and about rubbish-heaps, but so as to include as Natives a number of species such as *Viola tricolor*, *Senecio vulgaris*,

Pyrethrum inodorum, and the Nettles, which though most frequent in cultivated ground, are also to be met with in quarries and along the sea-shore, about road-sides and on waste ground, and which, by a little more stringent interpretation of the probabilities which point towards introduction, would be added to the Colonist list. All except four of our Colonists are plants of but annual duration. Many of them are of very frequent occurrence, and it is probable that a large proportion of them are plants which have had their original home in those lands where the Cereal Grasses were first cultivated, and that their seeds have been carried about with corn-seed from country to country. The Denizens, with the exception of one or two trees, and possible introductions along with ballast, are the well-established certain or probable introductions of Horticulture, and are mostly either ornamental plants, the common trees or shrubs with eatable fruit which are grown in gardens, or plants of real or supposed medical utility. *Populus alba*, *Sinapis muralis*, *Daphne Mezereum*, *Prunus avium* and *Chelidonium majus* are typical representatives of these five classes of character. It is to the Denizens, as the term is here employed, that M. Alphonse De Candolle* would restrict the use of the term 'naturalized,' denying it to the Colonists, but with us in Britain the word has been used with great looseness of application. The Aliens are plants which either make or have made their appearance in cultivated fields, casual stragglers from garden cultivation, imported trees not sufficiently established to take a place amongst the Denizens, or else species which have been introduced with ballast either from other parts of Britain, or from the European Continent. Of the Agricultural Aliens, *Melilotus vulgaris* and *Bromus arvensis* are examples: of the Horticultural Aliens, *Eranthis hyemalis* and *Cheiranthus Cheiri*: of the trees, *Carpinus Betulus* and *Castanea vesca*: of the ballast

* In M. De Candolle's elaborate handbook, entitled 'Geographie Botanique Raisonnée,' as well as in Watson's 'Cybele Britannica,' most of the matters are discussed in detail which in this chapter are just touched upon. These are the books which any of my readers who may wish to follow up the subject ought to procure.

plants, *Mercurialis annua* and *Galactites tomentosa*. So that, in respect of citizenship, we have five categories to separate the species amongst, viz. :—

1. The Natives, so far as we can now judge, the aboriginal possessors of the soil.

2 and 3. The Colonists and Denizens, the well-established importations of the Historic period.

4. The Aliens, importations not fully established.

5. The Incognita, species to be rejected from the list, either as being extinct, or as requiring confirmation before they can be claimed with safety.

The Stational Range of Species.—In treating of the distribution of species we have in the first place to consider the familiar facts as to what is called *station* or *habitat*. Amongst plants we all know that one affects woods and shaded places, another dry banks and wall tops, a third pastures and grassy commons, a fourth bogs and ditches, a fifth heaths, a sixth marshes by the sea-side and the vicinity of salt springs inland, a seventh cultivated fields and waste ground: some species being restricted, with but trifling exception, to one of these kinds of locality, others growing as if indifferently in two or three of the kinds, whilst others are to be met with habitually in several or almost all of them. Each species plainly has its own special power of adaptation to varied physical conditions, and that power is very different in different natural orders, different genera, and even often in different species of the same genus. It is the power of adaptation possessed by the plant which the geographical botanist has to deal with when he comes to consider it, just as the physiologist has to deal with its structure and the functions of its various organs, and the describer of species and systematist has to deal with its diagnostic characters. So much light or shade, such a kind of soil, so much heat, so much moisture, such a degree of consistency of soil; in regard to all these points each species has its own special constitution, and this must be provided for in every one of its stations in order to enable it to

stand its ground in them and prosper. To designate the different kinds of locality we may employ a series of adjectives such as sylvestral, pratal, pascual, ericetal, uliginal, agrestal, and say that *Drosera rotundifolia* is a uliginal, *Capsella bursa-pastoris* an agrestal, and *Hieracium tridentatum* a sylvestral plant. These terms answer the purpose of conveying, in connection with a species, the idea of a certain definite association of physical conditions ; but we must bear in mind when we employ them and read them that they do not, and from the nature of the case cannot, cover and give expression to much in regard to conditions of station which has an important bearing upon distribution, and that, for the most part, they deal only with such of what may be called the factors of station as are to be met with in most districts of an ordinary character. What I mean by this is, that in most tracts of country of any considerable extent there are to be found woods, hedges, meadows, pastures, bogs, heaths, and cultivated fields, the woods producing characteristically sylvestral species, the hedgerows characteristically septal species, the meadows and pastures characteristically pratal and pascual plants, and so on through the series. In a limited tract of country the most prominent facts of species-distribution, so far as we can trace any connection with physical agencies at all, are plainly to be associated with differences between the condition of different parts of its surface such as are expressed by these adjectives. But when we come to speak of the physical conditions and agencies which interfere to modify or regulate the distribution of species over a more extensive area, these adjectives answer our purpose no longer, and we are compelled to leave them behind.

The Influence of Temperature upon the Distribution of Species.—And then comes the question what are the factors that we can deal with which the terms we have alluded to do not cover which have a bearing upon the distribution of species on a grand scale. Of these, Temperature is plainly the most important, and the difference in the way in which in different cases its influence is

exercised opens out a wide field for research and consideration. A plant is not a mere machine, like a thermometer, but a living organism, and in considering the question we must take care to remember that such is the case. Conditions of life and biological phenomena we have need to bear constantly in mind, and here as elsewhere, the mysterious principle of vitality constantly interferes to limit the application of our generalisations. Especially have we to remember the differences in respect of duration which plants present. An Annual plant normally grows up to perfection, and produces flower and seed during the same year in which the seed that produces it was sown. A Biennial plant produces only stems and leaves the first year, flowers and fruit the second, and like the Annual, after one flowering and fruiting dies away. A Perennial plant lasts for an indefinite number of years, yielding flowers and fruit from the same root an indefinite number of times. So that in any locality the plants of these different categories in respect of duration are exposed in a very different manner to the range of variation which its temperature presents. Trees and shrubs, especially evergreens, are exposed more or less to the temperature of all the seasons of the year; herbaceous perennials and biennials, as a general rule, less so to the colds of Winter, especially in those countries where, as in ours, the cold almost suspends vegetation for a period, and where the ground is often overspread for a length of time with a covering of snow; whilst annuals mostly grow up to perfection and perish during, in our climate, a few months of the warmer part of the year.

Different species attain perfection at different seasons of the year, some earlier and some later, some in Spring, some in Summer, others in Autumn, some having a wide range of flowering and fruiting time, others opening out their flowers in any locality, at a particular time, year after year, with great regularity. No phanerogamous plant can develop itself below the freezing point, and in different plants the sap begins to circulate at very different degrees of the thermometer. The seeds of *Capsella*

bursa-pastoris begin to germinate at 33 or 34 degrees of Fahrenheit's thermometer, but the seeds of Wheat require a temperature of 38, and the seeds of Flax of 40 degrees before they will begin to swell. Willows and Poplars will sprout at a low temperature, whilst Vines, Liriodendrons, and Magnolias need a much higher one before their buds will begin to unfold. Each plant has, as it were, its own special zero, all degrees of temperature below which exercise, at any rate, no favourable influence upon its growth. So that not only does the development of species take place at different times and seasons, but we see also that the temperatures of even the same season of development, for each species require to be specially divided between three separate divisions, those which are too low to do it any good, those which are more or less useful to it, and those which are too high to do it any good. And from this it results that a comparison between two different localities, not only of the mean temperature of the year, but even of the mean temperature of any particular month or season, will often furnish results which will hold good only with much exception so far as the plants which they produce, and as some species more than others, are concerned.

So numerous and complicated are the influences which interfere to prevent the attainment of precision, that it seems to me by far the safest course not to attempt to speak of particular sums of temperature which species need in order to develop themselves, and that if we try to do so it is more likely to mislead and to confuse than to help us. If we wish to express in the form of a generalisation the bearing in our climate of temperature upon species-distribution, we must apparently say, that species are usually limited by cold, operating either *positively*, that is by the extreme colds or sudden falls of temperature in winter or the latter part of the autumn, or by the frosts of spring killing their young shoots and flower-buds, this principally applying to trees and shrubs, and especially to evergreens; or by cold operating *negatively*, if we may so speak, that is to say, by the want of a certain amount of heat spread over a certain period of time, the

heat being intense enough, and the period of time during which it is continued long enough, to enable them to produce their flowers and ripen their seeds, in the case of perennial species, if not every year, at least occasionally. This negative restriction must be the main one, and will apply to annuals, biennials and perennials alike, although the different periods of the year at which different species develop themselves must make a considerable difference in its application. Limitation by excess of heat often shews itself as limitation by the lessening of humidity, but with us, in restricting the distribution of plants, it evidently operates only in a comparatively unimportant manner.

The sums of summer heat and the extreme minima of the colder parts of the year are then the data of temperature with which botanical geography is specially concerned. The following propositions embody the principal details with regard to the distribution of our local temperatures which it seems needful to recall to mind in this connection. We must remember that in observations upon temperature it is the monthly means of the air in the shade that are stated, and no doubt these upon the whole are the data which are most valuable to have. But they are deduced from the average of a number of years, and sometimes the temperature of a month rises above and sometimes falls below the average. They take equal cognizance of all degrees of temperature alike, both those which affect plants and those which do not. The temperature which a plant receives is partly that of the air, and partly that of the ground, which is somewhat different to, and much more uniform than, that of the air. There is a wide difference, especially at the warmest part of the year, between the temperature in the shade and in places which are exposed to the sun, as the tables which are given at page 88 shew in detail; and what has been stated respecting the temperature of springs may also suitably be referred to in connection with plants. These propositions embody those details with regard to the distribution of local temperature which seem to have any prominent bearing upon the question we are now

considering. In giving them it is hardly necessary to say that they are a mere essay, of course as true and thorough as I can make it at this present time, but still, that with regard to various points which come within their range, our information and observations are very limited and incomplete.

1. In the shade, as compared with the temperature of the air at four feet from the ground, mean temperature is lower upwards, and several degrees lower upon the grass. The daily maxima in the sun are higher than the daily maxima in the shade, on an average of from 5 to 6 degrees in Winter to from 20 to 30 degrees in Summer.

2. At a depth of one foot in the ground the mean temperature is on the average fully one degree above the mean temperature of the air in the shade, the ground being proportionately or absolutely lower than the air in Spring and Summer, higher in Autumn and Winter; and the difference between the extreme months of the year being less in the ground than in the air by 5 degrees.

3. As we ascend from the low country amongst the hills, the mean temperature of the air sinks at an average rate of about one degree Fahrenheit per hundred yards, the lowering being apparently more in maxima than in minima, above the average in Spring and Summer, below it in Autumn and Winter, and the ground temperatures, especially the minima, falling less rapidly than the aerial means.

4. The distribution of absolute winter minima follows a totally different plan from that of the sums of summer heat; whereas these latter fall gradually as we ascend the hills, winter minima, on the contrary, are often conspicuously less extreme at an elevation than in the open low country, and instead of the temperature growing gradually lower as we ascend, within certain not very narrow limits it rises.

5. As compared with the inland low country, at the sea-side the annual means are slightly higher, and the absolute winter

minima conspicuously higher; but the sums of summer temperature are appreciably lower in proportion to the annual means.

The following table gives the number of species of the Flowering Plants and Ferns which have been noted at the various elevations from the low country upwards:

ALTITUDINAL RANGE OF THE FLOWERING PLANTS AND FERNS OF NORTH YORKSHIRE.

Height in Yards.	Number of Species.	Per centage of total flora.
Coast level & below 100yds.	859	86
At 50—100 yards	853	85
150	725	72
200	656	66
250	589	59
300	520	52
350	415	41
400	382	38
450	303	30
500	270	27
550	213	21
600	174	17
650	126	13
700	111	11
750	90	9
800	68	7
850	24	2½

It has been explained in the chapter on Climate that 86 of these species are essentially characteristic of a climate more boreal than that of our low country; but that the Montane species reached at any altitude as we ascend never compensate in number for the Ascending species which cease. In considering this table of the altitudinal range of species in connection with climate we must also take care to bear in mind what has been said respecting the stational range of plants, and to remember that, as we gradually ascend, not only are the sums of summer heat lowered, but that the range of station for plants also becomes gradually restricted. For instance, to recur to the adjectives employed to denote the different kinds of station, we may say, speaking in general terms, that when within our limits an altitude

of 400 yards is reached, such stations as are denominated by the terms paludal, viatical, agrestal, sylvestral and septal exist no longer, and that ericetal and uliginal greatly preponderate. We see that many plants stop short of our higher altitudes, and yet ascend elsewhere to much more boreal stations than we anywhere have them. For instance, with us there are no trees, either wild or planted, above 600 yards; but in the Scotch Highlands the Juniper ascends to 900 yards, the Rowan almost as high, the Scotch Fir, Birch, Raspberry, Hazel, Gale, Aspen, *Rosa villosa*, *R. spinosissima*, and several Willows, to 500 yards and upwards, 500 yards under the more northern latitude being more than equivalent to 600 yards in Yorkshire. But in spite of this it cannot be doubted that the lowering of the number of species as we ascend has a close connection with the lowering of the sums of temperature.

The Influence of Humidity upon the Distribution of Species.—The distribution of aerial humidity and of the rainfall over the surface of our field of study does not appear to exercise any considerable direct influence upon the topography of its flora. The paludal and lacustral plants which we have are naturally nearly all of them restricted to the valleys and the lower levels of the slopes. No doubt the greater humidity of the moorlands has something to do with the restriction to their vicinity of the characteristically Montane species, both the Flowering Plants and Ferns, and the Mosses; and tends also to bring about a greater frequency and luxuriance of many other damp- and shade-loving plants. The average number of characteristically Hygrophilous plants in the floras of the drainage districts is 39 for those of the West against 45 for those of the East. Of five inland species of the Atlantic type of distribution, three are confined to the eastern, two to the western districts. Taking the flora of the eastern and western sub-provinces as a whole, the most conspicuous and essential difference between them is expressed when we say that the West has a number of plants of the higher hills which the East has not, and the East has a number of plants of the sea-

shore which the West has not. The other species not common to both are not more specially damp-loving in one case than the other.

The influence upon the topography of our flora in respect of humidity exercised by the distribution of the subjacent rocks is considerable, but it is not needful to recapitulate or summarise here what has already been advanced upon this head. For what I have to say upon the matter the reader is referred to the chapter on Lithology.

Explanation of the Manner of Stating the Distribution of Species.—We may claim as plants of North Yorkshire very nearly three out of every four of the species which inhabit the whole of Britain. This proportion applies both as regards the Flowering Plants and Ferns, and also to the Mosses. In our list of species the fourth volume of the Cybele Britannica has been followed as a standard of nomenclature and arrangement, and what are there given as species are here given as species, with very trifling alteration. Occasionally, as in the case of *Callitriche verna* and *C. platycarpa*, I do not possess the materials for tracing out properly the distribution of two closely allied plants as distinct from one another, and have united them for this reason. I have not thought it necessary to take up space by giving the names of the Natural Orders. Under each species its type of distribution for Britain as a whole is given. These types were first worked out by Mr. H. C. Watson,* and are as follows:—

1. *British type.*—Species which are more or less generally diffused throughout the whole or nearly the whole of Britain.

2. *English type.*—Species which have their head-quarters in England, especially in the southern provinces, and become rare and finally cease altogether towards the north.

* The classification of species under their types of distribution as given by Mr. Watson in the fourth volume of the Cybele (pp. 175—221) has been followed implicitly; I have given here only the primary type to which each species is referred, but in the list in the Cybele the normal representatives of each type are distinguished from the species which are less characteristic.

3. *Scottish type.*—Species which, in a manner contrary to those which make up the last type, have their head-quarters in Scotland or the North of England, and become rare and finally cease altogether southward.

4. *Highland type.*—The boreal flora in a more intense degree. Species which have their head-quarters amongst the Scotch Highlands, and are only found southward in the vicinity of elevated mountains.

5. *Germanic type.*—Species which have their head-quarters in the south-east of England, and run out northward and westward.

6. *Atlantic type.*—Species which have their head-quarters in the south-west of England, and run out northward and eastward.

7. *Intermediate type.*—Species which have their head-quarters in the south of Scotland and the north of England, and run out both northward and southward.

8. *Local type.*—Species too much restricted in their range to take rank under any of the types which have been defined.

Next follows the category of citizenship to which, so far as North Yorkshire is concerned, the species seems to me properly to belong, Native, Colonist, Denizen, Alien or Incognit, as the case may be. The Alien plants of the Middlesbrough ballast-hills are given by themselves in a list at the end of the enumeration of the Flowering Plants.

If, as regards its distribution within our limits, the species belongs to any of the three geographical categories the plants of which stand out, geographically speaking, in most prominent relief from the general mass of the vegetation, the word Montane, Xerophilous, Subxerophilous, Maritime or Submaritime next follows.

The next item in most of the paragraphs is intended to show the horizontal distribution of the species, so far as this can be done by means of the drainage-districts which have been defined. If the 'Area' is given as 'general' the species is either reported to me upon good authority or has been seen by myself in all the nine drainage-districts. Upwards of one in three of the Native,

Colonist and Denizen species, are thus circumstanced. If a row of figures follow the word 'Area' the species is only known clearly in the districts which the figures indicate. It is only the distribution of Native, Colonist and Denizen species which is indicated as has just been explained; not that of Aliens, and figures are only given where the evidence in favour of the occurrence of a species seems to me of sufficient value to be worthy of acceptance. The drainage districts are indicated by figures as follows, as in the map, and the topographical part of this volume.

THE DRAINAGE DISTRICTS.

Vice counties of the Cybele Britannica	Number and Name of District.
North West Yorkshire	9 West Tees. 8 West Swale. 7 Yore.
Mid West Yorkshire (in part) ...	6 Nidd and Wharfe.
North East Yorkshire	5 East Tees. 4 Esk. 3 Derwent. 2 East Swale. 1 Ouse and Foss.

Next follows such an account as I am prepared to give of the Vertical Range of the plant within our limits. The species marked Coast-Level, except the Submaritime ones, are those which occur with us only amongst the sand-hills and cliffs of the coast-line. When a couple of numbers are given after the word 'Range' the first indicates the lower limit, the second the upper limit of the species. All species which descend below 100 yards, except a few marked 50, and those which are confined to the coast-line, have their lower limit stated as 0, and above 100 yards the limits are given in leaps of 50 yards. The upper limits above 100 yards are also given in leaps of 50 yards. Where one number only is given the ascertained vertical range of the species is under 50 yards, and that number

indicates the 50 yard point to which its station or stations are nearest. By Professor Phillips, the late Mr. Gray, and others, the heights of many of our prominent hills and of various points in the dales were many years ago ascertained, and now, in the maps of the Ordnance Survey, we are furnished with all that can possibly be desired in this respect. In stating both upper and lower limits I have gone upon the principle of keeping within the mark. A species which occurs from the valleys upward to a height of 1,900 feet has its Range given as 0-600. A considerable number of species which grow upon the Main Limestone of Mickle Fell at about 2,500 feet are given at 0-800. In those cases where I have not myself seen the localities for a plant I have, of course, had to estimate its altitudes as well as I could, but there are very few of the higher stations that are mentioned which I have not personally examined.

In the concluding portion of the paragraph devoted to each species is described in the first place the character of the stations in which it grows, woods, grassy places, cultivated fields, etc., as the case may be ; and after this is given a summary verbal outline of its distribution. The word 'Valleys' is only used in the restricted sense to which allusion has been made ; it covers no more than the New Red Sandstone and Kimmeridge Clay tracts of the geological map. What is said respecting the frequency of a species will of course be understood to be limited by what is said with regard to its range ; a species may be thinly scattered over a wide range or abundant within a limited range, though the converse holds true usually. For many of the less frequent, or more geographically interesting species, the names of the places in the neighbourhood of which they grow are given ; but it is only for the rarities that I have thought it needful to indicate special stations with any degree of minuteness. In enumerating places I have almost always begun with the north-west and proceeded towards the south-east. 'On the west,' if used without any qualification, means on the west of the Central Valley; 'on the east' refers in the same manner. Of the books which have

been consulted and the friends who have been laid under contribution for details, a table is given at the end of my list of species; but it is only for the stations of the rarer or more critical plants, where these have not been seen by myself, that authorities are quoted. A note of exclamation implies that I have seen an authentic specimen of the plant spoken of. For plants which have been described as species, but which do not rank as such in the 'Cybele Britannica,' I have endeavoured to make the list as complete as possible. But, except in the case of a few Aliens, unless a plant is treated in a separate paragraph, and, unless an Alien, if it has not a separate statement of 'Range' and 'Area' it is never included as distinct in any numerical table or summary.

THE FLORA

OF

NORTH YORKSHIRE.

THE FLORA.

Clematis Vitalba L. Alien. In Cleveland in hedges near Whitby; *Middleton*! and below the Warren near Guisbrough; *W. Mudd*! I have not seen the localities, but hesitate to accept the species as otherwise than an Alien. It is not clearly known as indigenous in Britain north of South Wales and the Severn province, and is not a plant of Denmark or Scandinavia. It is a species which is frequently planted as an ornamental shrub, and grows subspontaneously in one or two places where it has plainly been introduced, as in Duncombe Park, the woods at the Green near Richmond, and hedges at Sion Hill near Thirsk.

Thalictrum alpinum L. Highland type. Native. Montane. Area 9. Range 400-600. In Teesdale by the stream-sides upon the plateau and the slope towards the river of Cronkley Fell. Included in Fothergill's list of Wensleydale plants without any special station being mentioned.

Thalictrum minus L. Scottish type. Native. Area 8 . 5 4. Range Coast-Level and 500. The normal form is confined to the coast sand-hills. It grows in tolerable plenty from Coatham southward by way of Marske to Saltburn. *Thalictrum calcareum* Jordan occurs sparingly upon the Main Limestone scars of Booze Moor in Arkengarthdale.

Thalictrum flexuosum Reich. Intermediate type. Native. Montane. Area 9 . 6. Range 50-300. Stream-sides in the western dales, rare. By the Tees opposite Holwick, and in several places lower down as far as the Greta. By the Wharfe at Thorp Arch.

Thalictrum flavum L. English type. Native. Area 9 8 7 6 5 . 3 2 1. Range 0-100. Watery places in the valleys, one of the most frequent of the typically Hygrophilous species. Croft, Bedale, Kirklington, Snape, York, Thirsk, Woodend, Ainderby Steeple, Newby Wiske, Crambeck, Malton, etc.

Anemone Pulsatilla L. Germanic type. Native. Xerophilous. Area 9. Range 100. About the Magnesian Limestone at Cliffe Wood near Piercebridge; *W. Mudd.* This is its most northern station in Britain. It grows in several places upon the Magnesian Limestone terrace in West Yorkshire.

Anemone nemorosa L. British type. Native. Area general. Range 0-850. Shaded and grassy places, common in the dales and amongst the hills, but comparatively rare in the more cultivated parts of the valleys. It ascends to the peak of Mickle Fell.

Anemone apennina L. Alien. A native of Italy and Provence, which has been noted in a subspontaneous state about the Yore near Clifton Castle; *W. Mudd*; and in a wood near Beningborough Hall.

Adonis autumnalis L. Alien. Casually subspontaneous in cultivated fields. In Cleveland at Ayton and Crathorn; *W. Mudd.* Beningborough; *Hebblethwaite.*

Myosurus minimus L. Germanic type. Native. Area 7 6 . 3 2. Range 0-100. Sandy places in the Central Valley and Howardian tract, rare. Hutton Moor, near Ripon; *Simpson.* Hedge-bank by the side of the foot-path from Thirsk to Woodend, 1848. Dry banks at Holgate; *J. Backhouse*! Fields south-east of Welburn; *R. Teesdale.* Acomb; *G. Webster.*

Ranunculus aquatilis L. British type. Native. Area general. Range 0-350. Ponds and slow streams, common in the low country. Of the segregate species *R. heterophyllus* and *R. Drouetii* are frequent, and *R. floribundus* and *R. trichophyllus* also occur. *R. Drouetii* ascends Wensleydale to Hawes, and 1150 feet under Wegber Scar, Carperby; *J. Percival.*

Ranunculus Baudotii Godr. English type. Native. Maritime. Area 5. Range Coast-Level. Plentiful in the salt-water ditches in Coatham Marshes.

Ranunculus circinatus Sibth. English type. Native. Area 6 . 2. Range 100. In the fish-pond below Newburgh Hall, near Coxwold. Ditches of Askham bogs; *G. Webster.*

Ranunculus fluitans Lam. English type. Native. Area 8 . 2. Range 0-150. In Gilling Beck, near Richmond, along by Whashton, Gilling and Skeeby. In Codbeck, plentiful below Dalton, and in the Swale at Topcliffe and Aisenby.

Ranunculus hederaceus L. British type. Native. Area general. Range 0-650. Frequent in watery places, especially amongst the hills, ascending to a little tarn on the end of the fell on the north of the source of the Swale.

Ranunculus Lenormandi F. Schultz. English type. Native. Area 9 8 7. Range 350-550. Watery places in the western dales, rare. In Lunedale about the tarn on the southern slope of Mickle Fell, and in Gretadale near Sleightholme. In the ditches of the peat-moss in which the Swale rises, and plentiful about the highest sheep-fold. In the Yore district near the Skelgill lead-mines ; and on Penhill, and above Hardraw on both sides of the road leading from Hawes to Muker ; *J. Percival.*

Ranunculus Ficaria L. British type. Native. Area general. Range 0-300. Damp and grassy places, plentiful throughout the Lower Zone, ascending to the rocks at the foot of Whitstone Cliff.

Ranunculus Flammula L. British type. Native. Area general. Range 0-750. Frequent in watery places, especially amongst the hills, ascending to the peak of Dodd Fell and the springs which issue from the Main Limestone of Mickle Fell.

Ranunculus Lingua L. English type. Native. Area 9 8 7 6 5 . 3 2 1. Range 0-250. Watery places, not unfrequent in the low country. Semmer Water. In the Central Valley in Halnaby Carr, Newby Carr, Ainderby Carr, Newsham Carr, about the Wiske at Yafforth, Askham Bogs, Stockton Forest. In Cleveland about Langbargh Stell and in Morton Carr. In the East Swale district near Upsall and in Kilburn thicket. Boggy ground at the foot of Hood Hill on the west side ; *W. Foggitt.* In the Derwent district in ponds at Hildenley, near the Derwent at Kirkham, and about Scarborough Mere.

Ranunculus auricomus L. British type. Native. Area general. Range 0-400. Frequent in grassy and shaded places, ascending to Upper Cronkley, and the Underset Limestone scars of Kisdon.

Ranunculus acris L. British type. Native. Area general. Range 0-800. Common in grassy places, ascending to the Main Limestone of Cam Fell and Mickle Fell.

Ranunculus repens L. British type. Native. Area general. Range 0-750. Common in cultivated fields and damp and grassy places, ascending to the Main Limestone of Mickle Fell and above it in Gunnerside Gill and on Pinseat.

Ranunculus bulbosus L. British type. Native. Area general. Range 0-500. Grassy places, the commonest species of the three in the low country, but the least plentiful amongst the hills. It ascends to the limestone plateau of Kisdon.

Ranunculus hirsutus Curt. English type. Native. Area 5 . 3 2 1. Range 0-100. In the Central Valley in grassy places and cultivated fields at Scruton, Coatham, Thirsk, Carlton Miniott, and Alne, and on the Lias at Sheriff Hutton. One or two plants at Sandburn; *A. R. Waller.* Apparently a Native in some of its stations, and a Colonist in others, perhaps in most of them.

Ranunculus sceleratus L. British type. Native. Area general. Range 0-100. Watery places, frequent in the valleys, and occasionally beyond their limits, as at Masham and Pinchinthorpe.

Ranunculus parviflorus L. English type. Native. Area 2. Range 0-100. In the Central Valley on dry banks by the side of the foot-path between Romanby and Northallerton; *Foggitt*! Reported also by R. Teesdale from fields in the neighbourhood of Malton.

Ranunculus arvensis L. English type. Colonist. Area general. Range 0-250. Common in cultivated fields of the low country, ascending to the oat-fields of the Hambleton plateau over Hawnby.

Caltha palustris L. British type. Native. Area general. Range 0-750. Common in watery places, ascending to the springs which issue from the Main Limestone of Mickle Fell.

Eranthis hyemalis Salisb. Alien. A casual straggler from garden cultivation. A native of Italy and the south-west of France.

Trollius europæus L. Scottish type. Native. Montane. Area 9 8 7 . 5 4 3 2. Range 0-700. Watery places, frequent in the western dales, especially about the streams, ascending to the limestone plateau of Kisdon, and the northern slope of Mickle Fell. In the Central Valley at Croft, Bedale, Burniston, Camphill, Aisenby, Sandhutton, and Stockton-on-Tees. In the Vale of Mowbray behind Mount St. John. In Cleveland at Stokesley, and in Goathland-dale and Eskdale. Amongst the eastern hills in Snilesworth, Beckdale, Wrelton Woods near Pickering, and the lower part of the dale of Rye. In the Howardian tract at Terrington, Wiganthorp, Hovingham, and Castle Howard, and in the Vale of Pickering at Ryton Bridge.

Helleborus viridis L. Germanic type. Native. Xerophilous. Area 9 8 7 . 3. Range 50-250. About the Swale at Brompton, and in a pasture at Kirkby Fleetham. In the Yore district at Spennithorne ; and about the Magnesian Limestone at Piercebridge and Tanfield. East end of Leyburn Shawl ; *W. Horne*. Pasture about a quarter of a mile S.E. of Thoresby Green, Carperby ; *J. Percival*. In the dales of the eastern calcareous range in numerous stations ; Rievaulx, Beckdale, Wass Woods, Dowthwaite Dale, Forge Valley, and in the Howardian tract at Coneysthorpe, in Mowthorp Dale, and at Spittle Hill near Malton. A plant of the aboriginal woods of the calcareous dales, where it grows with *Actæa*, *Aquilegia*, *Melica nutans*, *Rubus saxatilis*, etc., and a characteristic example of the Xerophilous role of distribution.

Helleborus fœtidus L. Germanic type. Denizen. Area 2. Range 50. Apparently indigenous at Brompton near Northallerton, where it grows plentifully in Fullerker Lane and

about the borders of the adjoining fields; *Wheldon*! Oldstead bank, abundant; *W. Foggitt*. The species occurs, but only in a sub-spontaneous condition, in a few other places; Camphill, Tanfield, Great Ayton, Rosedale Abbey.

Aquilegia vulgaris L. English type. Native. Xerophilous. Area 8 7 6 . 3. Range 50-350. Like *Helleborus viridis* and *Actæa*, a characteristic example of the Xerophilous category. For an account of its stations see page 65.

Aconitum Napellus L. Alien. Sub-spontaneous by stream-sides in a few places, but clearly a garden escape. By the Tees at Yarm, the Leven at Ayton, the Swale at Richmond, the Wharfe at Thorp Arch. Possibly indigenous in the south-west of England; clearly so in Denmark, Germany and France. Cultivated in gardens up to 300 yards.

Pæonia corallina Retz. Alien. In Cleveland sub-spontaneous or planted in Kildale Woods; *W. Mudd*! Cultivated in gardens up to 350 yards.

Delphinium Ajacis L. Alien. Casually sub-spontaneous in cultivated fields. Thirsk, Langbargh, Picton, Crathorn, etc.

Actæa spicata L. Intermediate type. Native. Xerophilous. Area 8 7 6 . 3. Range 50-350. In the Yore district in Whitfield Gill, on both sides of the stream near the waterfall, and about a lime-kiln near the river at High Mains, near Masham. About the Magnesian Limestone at Thornton Watlass and Thorp Arch. In the woods of the slopes of the eastern calcareous range in numerous stations: Yowlasdale, Cold Kirkby, Rievaulx, Beckdale, Yedmandale, Forge Valley, and in the Howardian tract at Nunnington, Hovingham, Hildenley, and in Cawklees Wood. In its North Yorkshire distribution almost precisely the same as *Aquilegia*, and with the same vertical range. Beyond the limits of Yorkshire it is in Britain found only in the Lake district. It is distributed throughout Scandinavia, and southward through Denmark, Belgium and France, to the Pyrenees.

Nymphæa alba L. British type. Native. Area 5 . 3 . 1. Range 0-100. Ponds and streams in the vales, rare. In the

ditches in the neighbourhood of the Tees at Yarm and South Stockton, in the Derwent from Malton downwards to Stamford Bridge, and in the lower part of the Foss. Occasionally planted elsewhere in ponds.

Nuphar lutea Smith. English type. Native. Area 9 8 7 . 5 . 3 2 1. Range 0-250. In similar situations to the preceding, but more frequent, and with a wider vertical range. Semmer Water, Croft, Yarm, South Stockton, Bedale, Snape, Northallerton, Thirsk, York, Malton, Scarborough, etc.

Papaver hybridum L. English type. Colonist. Area 3 2. Range 0-100. Reported by Dr. Wasse from Thirsk, and by R. Teesdale from the neighbourhood of Malton, but not seen recently.

Papaver Argemone L. British type. Colonist. Area 8 7 6 5 4 3 2 1. Range 0-200. Frequent in cultivated fields, ascending in Wensleydale to Carperby.

Papaver dubium L. British type. Colonist. Area general. Range 0-200. Frequent in cultivated fields in the low country, ascending Wensleydale to Askrigg; *J. Percival.* The common plant of North Yorkshire is authenticated by Boreau as *P. Lamottei*. *P. Lecoquii* is doubtful as a plant of our limits.

Papaver Rhœas L. British type. Colonist. Area general. Range 0-300. Cultivated fields throughout the Lower Zone, much the commonest within our limits of the three species. Ascends Wensleydale to Carperby; *J. Percival.* The var. *strigosum* has been gathered by Moore at Acomb, and by myself at South Kilvington and between Croft and Stapleton.

Papaver somniferum L. Alien. Casually sub-spontaneous in waste ground, Richmond, Scarborough, etc.

Meconopsis cambrica Vig. Atlantic type. Native? Area 7. Range 300-350. Probably indigenous in Mossdale near Hawes, where it was long ago found by Brunton; but apparently introduced in all its other stations; Aysgarth Force, Woodend, Kildale Woods, Robin Hood's Bay.

Chelidonium majus L. English type. Denizen. Area general. Range 0-250. Frequent in hedges in the low country, but always, where I have seen it, in the neighbourhood of houses or gardens. It ascends in Wensleydale to Aysgarth and Redmire, and is grown in a garden on Marrick Moor at 300 yards. It is sometimes used as a medicine for cows, which perhaps may account for its being met with so often about farm-houses and villages.

Glaucium luteum Scop. English type. Denizen. Area 5 4. Range Coast-Level. Sandy ground near the sea, rare, probably introduced in one and possibly in both its stations. It grows near the mouth of the Tees at Middlesbrough, and amongst the sand-hills near the mouth of the Esk at Whitby.

Glaucium violaceum Smith. Alien. A weed in the nursery grounds at Hopetown near Burniston ; *Hebblethwaite* !

Glaucium phœniceum Crantz. Alien. A plant often grown in cottage gardens, which is sometimes to be met with in waste ground. Cotherstone, Ainderby Steeple, Thirsk, Rievaulx, etc.

Corydalis claviculata DC. British type. Native. Area 9 . 5 4 3. Range 50-150. Heathery places, rare. In the west about the crags of Cat Castle in Deepdale. On the east in several places : hedges at Great Ayton, Eston Nab, Aislaby Quarries, Bulmer Hag, Wrelton Woods, Langdale Rigg. Asledale, north of Helmsley, abundant ; *W. Foggitt.*

Corydalis lutea DC. Alien. A species often grown in gardens, which is sub-spontaneous on old walls in several places. Richmond, Swinton, Tanfield, Kilton Castle, Whitby, Pickering, Arden Hall, etc. A native of Italy and Illyria.

Corydalis solida DC. Alien. Occasionally sub-spontaneous as a garden escape. Norton Conyers, Wath, Thirsk, etc. A native of Scandinavia, Germany and France.

Dielytra formosa DC. Alien. Sub-spontaneous or planted in a wood near the High Force of Semmerdale ; plentiful

in 1859; *Wheldon*! A native of America, much cultivated in gardens.

Fumaria capreolata L. British type. Colonist. Area 8 . 6 5 4 3 2 1. Range 0-150. Not unfrequent in cultivated ground and its neighbourhood in the low country. Richmond, Northallerton, Thirsk, Raventhorp, Guisbrough, York, Kirkleatham, Upleatham, Whitby, Castle Howard, Scarborough. The common plant of North Yorkshire is authenticated by Boreau as *F. Borœi*, and *F. pallidiflora* also occurs. The true *F. muralis* I do not know as a plant of the Riding, and *F. confusa* as a ballast plant only.

Fumaria officinalis L. British type. Colonist. Area general. Range 0-300. Common in cultivated fields amongst the vales and slopes. Ascends Wensleydale to Hawes; *J. Percival.*

Fumaria parviflora Lam. Germanic type. Colonist. Area 3. Range 50. Gathered in 1858 by W. Bean, junr., in cultivated fields in the Vale of Pickering, near Seamer. Abundant there in 1862.

Fumaria Vaillantii Lois. Germanic type. Colonist. Area 3. Range 100. Gathered in the summer of 1858 by a party from Thirsk, of which I was one, in a vetch-field below Cawton Heights, near Hovingham.

Cakile maritima Scop. British type. Native. Maritime. Area 5 4 3. Range Coast-Level. Plentiful amongst the salt marshes at Middlesbrough and Coatham; more sparingly along the coast-line southward by way of Marske, Saltburn, Sandsend, Whitby, and Scarborough.

Crambe maritima L. English type. Native. Maritime. Area 5 4. Range Coast-Level. Sparingly on the sands at Coatham; *Flora.* Huntcliffe; *D. Ferguson.* On the cliff at Whitby; *Brunton.* Introduced with ballast to the railway bank near Thirsk Junction; *W. Foggitt.*

Coronopus didyma Smith. Alien. Waste ground near the sea at Cargo-fleet; *W. Mudd*! Ballast hills at Middles-

brough; *W. Foggitt.* Reported also by Robson from Scarborough. Considered by A. De Candolle as a plant introduced into Europe from Temperate America.

Coronopus Ruellii Gaertn. English type. Native. Area 8 7 6 5 4 3 2 1. Range 0-200. Not unfrequent by road-sides and in waste ground in the low country. Richmond, Leyburn, Bedale, Camphill, Thirsk, York, Middlesbrough, Guisbrough, Great Ayton, Staithes, Coatham, Sandsend, Whitby, Terrington, Scarborough, etc. It ascends to the eastern extremity of Leyburn Shawl.

Thlaspi arvense L. British type. Colonist. Area 8 7 . 5 4 3 2. Range 0-200. Cultivated fields in the low country, rare. Richmond, Leyburn, Camphill, Guisbrough, Hutton Rudby, Thirsk, Hovingham, Castle Howard, etc.

Thlaspi alpestre L. Intermediate type. Native. Montane. Area 8 7. Range 250-500. Abundant about the Hind Rake and Copperthwaite lead-mines, near Reeth. It is also reported by James Ward from Hurst Head, and I have seen it sparingly with *Armeria* at Woodhall. In great abundance along the banks of Ellerbeck, near Hawbank lead-mines, and about the old lead-mines in Oxclose, Carperby; *J. Percival.* This lead-mine plant, in North Yorkshire as at Malham, is all *T. occitanum* Jordan. The plant which grows in the fir plantation on the Durham side of the Tees at Winch Bridge is authenticated by Boreau as *T. sylvestre.*

Capsella Bursa-pastoris L. British type. Native. Area general. Range 0-400. Common in cultivated fields and waste ground, ascending to Upper Cronkley and Sleightholme.

Hutchinsia petræa R.Br. Intermediate type. Native. Montane. Xerophilous. Area 8 7. Range 200-500. Not unfrequent amongst the limestone scars of the western dales. In the West Swale district on Copperthwaite scars and other places about Reeth and Hurst. In the Yore district from Hawes eastward to Aysgarth in several places; the Buttertubs

Pass, Addlebrough, Semmerdale, and descending to walls at West Burton.

Teesdalia nudicaulis R.Br. English type. Native. Area 7 6 . 3 . 1. Range 0-300. Rare in sandy ground, but with a comparatively wide vertical range. Amongst the flagstone quarries of Leyburn Moor, with *Arenaria tenuifolia*. Hutton Moor, near Ripon; *J. Dalton*! Fields near Alne; *Pierson*. Walls on the Newburgh side of Yearsley Moor; *H. Ibbotson*. Fields at Bulmer; *R. Teesdale*. Hawnby; *H. R. Moiser*. Sandy field near Pilmoor, abundant; *W. Foggitt*. Ainsty; *G. Webster*. Hob Moor; *W. Kirkby*.

Iberis amara L. Alien. An occasional straggler from garden cultivation. Cultivated up to 350 yards.

Lepidium latifolium L. English type. Denizen. Area 5 4. Range 0-100. Hedge-bank between Yarm and High Worsall; *T. J. Foggitt*! Redcar; *Leefe*. Coast cliffs between Redcar and Sandsend; *Flora*.

Lepidium Draba R.Br. Alien. Besides its occurrence at Middlesbrough this species has been found by Edwin Lees in waste ground upon the cliff at Whitby, and by B. B. LeTall at Strensall. It is a native of the South of Europe.

Lepidium campestre R.Br. British type. Native. Area general. Range 0-250. Frequent in sandy fields and upon dry banks, ascending in Wensleydale to Appersett Bridge.

Lepidium Smithii Hook. British type. Native. Area 7 6 5 4 . 2. Range 0-100. In similar situations to the preceding, but less frequent and not ascending so high.

Lepidium ruderale L. Alien. Scarborough Old Pier; *Middleton*! Reported also from Coatham Marshes, which I have often searched without seeing it.

Lepidium sativum L. Alien. An occasional straggler from garden cultivation. Cultivated up to 500 yards.

Cochlearia officinalis L. British type. Native. Area 9 8 7 6 5 4 3. Range 0-800. Common along the coast-line from Stockton-on-Tees to Scarborough. Inland amongst the

western hills it is not unfrequent. It ascends to the Peak of Great Whernside and the Main Limestone of Mickle Fell, and, like *Myrrhis*, descends with the streams into the central valley. So that it has, in fact, a widely diffused 'Montane' superadded to a 'Maritime' role of distribution. *C. anglica* and *C. danica* I do not know as growing within our limits.

Armoracia rusticana Baumg. Alien. Commonly grown in gardens and occasionally subspontaneous in waste ground. It is well established by the side of Codbeck, between Dalton and Topcliffe Bridge.

Draba muralis L. Intermediate type. Native. Xerophilous. Area 9. Range 300-400. Limestone rocks, Sleightholme Beck, near Bowes, 1876; *J. P. Soutter.*

Draba incana L. Highland type. Native. Montane. Subxerophilous. Area 9 8 7. Range 350-800. Frequent amongst the calcareous scars of the western dales. In the West Tees district on Cronkley Scars, the Sugar Limestone of Cronkley Fell, the Main Limestone of Mickle Fell and Gilmanscar. In the West Swale district plentiful on the scars of Booze Moor and both upon the northern and western slope of Kisdon. Hell Gill. In the Yore district upon the cliffs of Widdale Fell, Stag's Fell, Addlebrough, Semmerdale, Waldendale, etc.

Draba verna L. British type. Native. Area general. Range 0-800. Common upon walls and dry banks, ascending to the Main Limestone of Askrigg Moor and Mickle Fell. The common plant of North Yorkshire is *Erophila majuscula* Jordan! *D. præcox* Stev., *E. brachycarpa* Jordan! grows upon walls of calcareous gritstone at Scawton and Rievaulx, and is not unfrequent on limestone rocks in Upper Wensleydale; *J. Percival*; and a plant closely allied to the Breadalbane *D. inflata*! upon walls in the Vale of Mowbray at Westow.

Camelina sativa Crantz. Alien. Not unfrequent as a casual weed in cultivated fields, especially of flax. The common plant of North Yorkshire is true *C. sativa*, but *C. dentata* Pers. also occurs.

Alyssum calycinum L. English type. Colonist. Area 8 7 6 5 . 3 2. Range 0-200. Not unfrequent in cultivated fields, especially in the sandier portions of the Central Valley. Wath, Kirklington, Nether Poppleton, Acomb, Thirsk, Woodend, Carlton Miniott, Northallerton, Great Ayton, Ganthorpe, etc. The highest station in which I have seen it is the plateau of the calcareous hills above Rievaulx.

Alyssum incanum L. Alien. In a forage field near Pickering; *G. H. Lightfoot*! Seed field near Breckenborough; *Miss Hincks.*

Cardamine amara L. British type. Native. Area general. Range 0-300. Frequent in watery places in the Lower Zone, ascending to Holwick and 1,000 feet in Gayledale above Hawes; *F. A. Lees.*

Cardamine pratensis L. British type. Native. Area general. Range 0-800. Common in damp and grassy places, ascending to the Main Limestone of Mickle Fell.

Cardamine hirsuta L. British type. Native. Area general. Range 0-800. Common upon banks and rocks, with the same vertical range as the preceding. *C. sylvatica* Link is frequent in shaded woods, especially in the dales.

Cardamine impatiens L. Incognit. Reported by R. Teesdale from the neighbourhood of Richmond, but not seen recently.

Arabis thaliana L. British type. Native. Area general. Range 0-500. Frequent upon walls and dry banks, ascending to Hell Gill and the Main Limestone scars of the Buttertubs Pass.

Arabis petræa Crantz. Incognit. Reported from rocks upon the slope below Whitston Cliff, apparently in error for *Cardamine hirsuta.*

Arabis hirsuta R.Br. British type. Native. Subxerophilous. Area 9 8 7 6 . 3 2. Range 50-500. Frequent upon the Limestone Scars of the western dales, ascending to Cronkley Scars and the Main Limestone cliffs of Punchard's Gill and Booze Moor. About the Magnesian Limestone at Tanfield and

Thorpe Arch. In the Central Valley at Bedale, Kirklington, Acomb, and Sowerby. Old wall at Acomb; *W. Whitwell.* On the east in many places amongst the calcareous hills and Howardian tract, also on sandstone walls at Coxwold, Newburgh, and Upsal Castle.

Turritis glabra L. Germanic type. Native. Area 8 . 2. Range 0-100. Sandy fields in the Central Valley in several places. Catterick Bridge, Brompton-on-Swale, Kirklington, Leeming Lane, Leckby, Helperby, Skipton Bridge, Carlton Miniott, etc.

Barbarea vulgaris R.Br. British type. Native. Area general. Range 0-300. Common in watery places in the low country, ascending to Cotherstone and Hawes. *B. arcuata* occurs occasionally, and a form which might easily be mistaken for the following, and which is probably the var. *sylvestris* of Fries, grows along with it on Clifton Ings.

Barbarea stricta Fries. English type. Native. Area 6 . 1. Range 0-100. With the preceding about the Ouse along Clifton Ings and in other places in the neighbourhood of York, where it was discovered by Mr. Borrer. Reported by Mr. Simpson from Leeming Lane, but I have not seen specimens. A species widely diffused upon the continent, but singularly local in Britain.

Barbarea intermedia Boreau! Intermediate type. Colonist. Area 3 2. Range 0-150. Has occurred in cultivated fields near Thirsk in several places; *W. Foggitt.* I met with this in 1862, in cultivated fields at the lower end of Bilsdale, on the slope of Easterside towards Hawnby.

Barbarea præcox R.Br. Alien. Casually subspontaneous in waste ground. Richmond, Wensley, Camphill, Welburn, etc. Railway embankment at Thirsk; *W. Foggitt.*

Nasturtium officinale R.Br. British type. Native. Area general. Range 0-350. Common in ditches and slow streams, ascending to the moor above Preston-under-Scar.

Nasturtium terrestre R.Br. English type. Native. Area 9 8 7 6 5 . 3 2 1. Range 0-100. Damp places, not unfrequent

in the vales, and occasionally beyond their limits. Carperby, Burton Constable, Ainsty, Sheriff Hutton, Thirsk, Ganthorpe, Terrington, etc.

Nasturtium sylvestre R.Br. English type. Native. Area 8 7 6 . 3 2 1. Range 0-100. Watery places, frequent in the vales and occasionally beyond their limits. Banks of the Swale, Wiske, Ouse, Foss, and Derwent. In Cleveland at Newton, and in Coatham Marshes.

Nasturtium amphibium R.Br. English type. Native. Area 8 . 6 . 3 2 1. Range 0-100. Watery places, frequent in the damper parts of the vales.

Sisymbrium officinale L. British type. Native. Area general. Range 0-250. Common along road-sides and in waste ground in the low country, ascending in Swaledale to High Fremington, in Wensleydale to Aysgarth.

Sisymbrium Sophia L. English type. Native. Area 8 7 . 5 . 3 2. Range 0-150. In similar situations to the preceding, but much less frequent. Brompton-on-Swale, Wensley, Fencote, Carthorpe, Nosterfield, Thirsk, North Kilvington, Middlesbrough, Malton, Scarborough, etc.

Sisymbrium Irio L. Alien. Old walls at York; *J. Blackburn*, 1850. Name authenticated by F. A. Lees.

Erysimum cheiranthoides L. Alien. Occasionally subspontaneous in cultivated fields and waste ground. Leeming, Masham, Well, Thirsk, York, Hovingham, Terrington, etc. *E. virgatum* has been met with by James Ward in Swaledale, between Reeth and Marrick.

Erysimum Alliaria L. British type. Native. Area general. Range 0-250. Common upon shaded banks in the low country, ascending in Swaledale to the foot of the Red Scar near Downholme, and in Gretadale to Gilmonby near Bowes.

Cheiranthus Cheiri L. Alien. Occasionally subspontaneous or planted on old walls. Bowes Castle, Rokeby Castle, Mortham's Tower, Richmond Castle, Redmire, Jerveaux Abbey,

Tanfield Church, Upsal Castle, Danby Castle, St. Mary's Abbey, and Clifford's Tower at York, etc. Indigenous in Greece and the south-west of Europe.

Hesperis matronalis L. Alien. Occasionally subspontaneous by stream-sides and in waste ground. Lonton, Lartington, Richmond, Aysgarth, Wensley, Hutton Conyers, Rievaulx, etc. Grown in gardens up to 350 yards.

Brassica oleracea L. Atlantic type. Denizen. Area 4. Range Coast-Level. Huntcliffe; *D. Ferguson.* Plentiful amongst the coast precipices in the vicinity of Staithes, whence it is recorded in the original Botanist's Guide by Archdeacon Peirson, and where I saw it in plenty in 1881, but near the village only. It occurs in more suspicious stations near Whitby and Scarborough, and is an occasional weed of cultivated fields inland. It is grown up to 500 yards, but will not stand the winters of our middle zone.

Brassica Napus L. English type. Colonist. Area general. Range 0-300. Cultivated throughout the lower zone and frequently subspontaneous by stream-sides, etc. Apparently indigenous in Scandinavia and Russia.

Brassica Rapa L. English type. Colonist. Area general. Range 0-300. Cultivated up to 500 yards, but like all the other cultivated crops, only grown casually above 400 yards. Upon the heavy soils of the Lias and Gritstone the turnip and oat are more profitable and successful than anything else. Like the preceding, it is frequent in a subspontaneous state in cultivated fields and along streams, and for its original home we must probably look in the same direction.

Sinapis arvensis L. British type. Colonist. Area general. Range 0-350. One of the commonest weeds of cultivated fields, and ascending as high as field-cultivation reaches.

Sinapis alba L. English type. Colonist. Area 9 8 7 6 5 4 3 2. Range 0-200. Occasionally grown in fields and gardens up to 500 yards, and sometimes occurring as a weed. The highest

point where I have seen it in a subspontaneous state is Redmire in Wensleydale.

Sinapis nigra L. English type. Colonist. Area 7 6 5 4 . 2 1. Range 0-200. Occasionally cultivated, and also an occasional weed of cultivated fields and waste ground. Perhaps a native on the coast at Baytown (Robin Hood's Bay).

Sinapis tenuifolia L. English type. Denizen. Area 8 . 5 4 3 2. Range 0-100. Along the coast plentiful about Middlesbrough and Coatham, and rarer southward about Whitby and Scarborough. Inland in a field between Newby Wiske and Kirkby Wiske, upon a hedge-bank at Thirsk, upon the railway embankment at Guisbrough, and in the limestone quarries at Malton. Introduced with ballast to the railway bank near Thirsk Junction; *W. Foggitt.* Railway bank at Northallerton, 1887; *J. Wheldon.* Probably a genuine native of North Yorkshire.

Sinapis muralis L. English type. Denizen. Area 5 4 . 2. Range Coast-Level. Along the coast in waste ground about Middlesbrough and Coatham, and by the side of the Esk below Ruswarp. In this latter station it was first noted by Edwin Lees. Established also on the railway embankment at Thirsk; *W. Foggitt.*

Raphanus Raphanistrum L. British type. Colonist. Area general. Range 0-350. Not so common as *Sinapis arvensis*, but like that species a weed of cultivated fields, and ascending as high as field-cultivation reaches. *Raphanistrum arvense* Reich. is not unfrequent.

Reseda luteola L. British type. Native. Area general. Range 0-250. Frequent in dry places, ascending to the plateau of the calcareous range over Rievaulx. Ascends Wensleydale to Redmire and road-side over Leyburn Shawl; *J. Percival.*

Reseda lutea L. English type. Native. Area 7 6 5 4 3 2 1. Range 0-100. In similar situations to the preceding, but less frequent. More abundant about Middlesbrough and along the coast line to Coatham than anywhere else within our limits.

Reseda fruticulosa L. Alien. A casual straggler from garden cultivation. Wall near Richmond Mill; *James Ward.* Rye Bank between Nunnington and West Ness; *H. Ibbotson.* Indigenous in France and the South of Europe.

Helianthemum vulgare Gaertn. British type. Native. Xerophilous. Area 9 8 7 6 5 4 3 2. Range 0-700. Frequent amongst the calcareous hills on both sides of the Central Valley, ascending to the limestone edges of the northern slope of Mickle Fell. About the Magnesian Limestone at Thorpe Arch and in the Yore district. In the Central Valley at Burniston, and in Cleveland between Crathorn and Hutton Rudby. On the coast at Saltburn.

Helianthemum canum Dun. Intermediate type. Native. Xerophilous. Area 9. Range 600. With the preceding and *Hippocrepis*, plentiful on the sugar limestone of Cronkley Fell. The Yorkshire form is *H. vineale* Pers.

Viola palustris L. British type. Native. Area 9 8 7 6 5 4 3 2. Range 0-700. Frequent in swamps amongst the hills, ascending to the slope of Mickle Fell towards Cronkley. Occasionally in the Central Valley, as at Halnaby Carr, and with *Lysimachia thyrsiflora* at Carlton Carr and Askham Bogs.

Viola odorata L. English type. Native. Area general. Range 0-150. Frequent in shaded places in the low country, ascending to Beckdale Woods, in Swaledale to Fremington, and in Wensleydale to Carperby and Bain Gill; *J. Percival.* Clearly indigenous in many of its localities, but no doubt sometimes an introduction. Our White Violet is a mere form of this species, and is not *V. alba* Besser.

Viola hirta L. English type. Native. Subxerophilous. Area 9 8 7 6 5 4 3 2. Range 0-300. Frequent amongst the calcareous hills on both sides of the Central Valley, ascending to Winch Bridge, Preston Scar, Leyburn Shawl, and Hawnby Bank. About the Magnesian Limestone at Thorpe Arch. In the Central Vale at Kirklington and Northallerton. On the basaltic ridge at Langbargh. Amongst the coast sand-hills at

Coatham, and on the east in a few other places apart from the hills, as Knayton, Hood Grange, Mowthorpe Dale, etc. *V. sepincola* Jordan occurs on sandy banks near Tanfield Hall and by the Yore side in the same vicinity and in woods at Beckdale near Helmsley, and most likely some of the other numerous intermediates between this and the preceding are also to be met with.

Viola sylvatica Fries. British type. Native. Area general. Range 0-800. Common both in shaded and exposed grassy places, ascending to the Main Limestone of Cam Fell, Widdale Fell, and Mickle Fell. This range is that of *V. Riviniana* Reich. *V. Reichenbachiana* Jordan occurs in shaded places in the vales and low country, but I have not seen it above 150 yards. It is frequent in Lower Wensleydale; *J. Percival.* Var. *velutina* Lees, a form with hairy leaves, has been gathered in Mossdale by F. Arnold Lees and William Whitwell.

Viola flavicornis Smith. British type. Native. Area 8 . 6 . 1. Range 50. In the carr by the side of the Wiske opposite Newby Wiske, where it was found by Mr. Umpleby. Amongst furze in Askham Bog, a single tuft, 1871; *F. A. Lees.* In one or two places on Strensall Common; *A. R. Waller.*

Viola tricolor L. British type. Native. Area general. Range 0-350. Common in cultivated fields from the vales upwards as high as field-cultivation reaches. It would perhaps range better with the Colonists than the Natives, but it grows occasionally in woods, as at Newburgh and Carlton Carr. The three corn-field Pansies of the neighbourhood of Thirsk were referred by Professor Boreau, one to *V. contempta* Jordan, the two others doubtfully to *V. Lloydii* and *V. peregrina.* The latter I have seen in one place only, the two others are common.

Viola lutea Huds. Scottish type. Native. Montane. Area 9 8 7 . 3 2. Range 150-800. Frequent in grassy places amongst the western hills and dales, ascending to the Main Limestone of Mickle Fell and the plateau of Pinseat, descending in Teesdale to Lonton, and in Swaledale to the Swale side at Applegarth.

It was formerly found in the Central Vale at Kirkby Hill near Boroughbridge, but has been extinct there since 1823. Rare amongst the eastern moorlands; Kepwick Nab, Seamer Moor. A curious plant (var. *hamulata* Baker) with small yellow flowers, petals standing forward as in the corn-field *V. arvensis*, and stipules with sickle-shaped lateral and crenate leafy terminal lobes, which grows upon the Richmond race-course, and with *Thlaspi occitanum* in the neighbourhood of Reeth, does not appear to be essentially distinct.

Drosera rotundifolia L. British type. Native. Area 9 8 7 . 5 4 3 2 1. Range 0-750. Frequent in heathery bogs from the vale heaths upwards to the peaks of Lovely Seat and Nine Standards Rigg, and the springs which issue from the Main Limestone of Mickle Fell.

Drosera intermedia Hayne. English type. Native. Area 3 . 1. Range 0-100. Frequent amongst the sandy heaths of the Central Valley: Stockton Forest, Strensall Common, Pilmoor; and more sparingly in the Howardian tract on Slingsby Moor and Terrington Carr.

Drosera anglica Huds. Scottish type. Native. Montane. Area 8 . 5 . 3. Range 0-300. In the Central Valley plentiful with *Scheuchzeria* in Leckby Carr. In Cleveland on Battersby Moor; *W. Mudd.* In the Howardian tract in Terrington Carr, where it was first noted by R. Teesdale. *D. obovata* M. & K., a hybrid between *D. anglica* and *D. rotundifolia*, has been found by William Whitwell at Leckby Carr.

Polygala vulgaris L. British type. Native. Area general. Range 0-600. Common in grassy places, ascending to the plateaux of Pinseat and Cronkley Fell. *P. depressa* Wender. is frequent upon heaths. *P. oxyptera* Reich. is found occasionally on limestone.

Polygala amara L. = *P. austriaca* Crantz. Intermediate type. Native. Montane. Area 9. Range 550-600. (See page 138). In Teesdale this species grows sparingly upon the banks of the eastern fork of the streamlet which forms the

White Force. It was discovered there by the Backhouses in 1852, and ten years later they met with it upon one of the sugar limestone hillocks of the Cronkley plateau.

Dianthus deltoides L. English type. Native. Area 3. Range 100. This is known in one station only, a dry gravelly place called the Coom, situated about half-a-mile south of Terrington, where it was found by H. Ibbotson. *D. barbatus* and *D. plumarius* are both upon record as plants of the Ainsty, but they grow only where they have been planted in the grounds by the Wharfe side above Thorpe Arch.

Dianthus Armeria L. English type. Native. Area 1. Range 0-100. Sandy bank at Skelton, July, 1862; *H. Ibbotson.*

Saponaria officinalis L. English type. Denizen. Area 9 8 . 6 5 4 3 2 1. Range 0-100. By the Tees side at Dalton, Worsall, and Yarm. On the castle bank at Richmond, and along the Swale and Ouse in numerous places as far down as York. On the castle hill at Scarborough; also in many other places in fields and upon hedge-banks; Crathorn, Hutton Rudby, Kirklington, Northallerton, Kirkby Wiske, Thirsk, Acomb, Malton, Strensall, Robin Hood's Bay, etc. Probably indigenous in some of its stations, but no doubt introduced in others.

Saponaria Vaccaria L. Alien. Sent to me by Mr. Bean from Scarborough, where it has once been found in a cultivated field. Corn-field between Thirsk and Woodend, 1876, and with *Vicia varia* on Bagby Moor, 1886; *W. Foggitt.*

Silene inflata Sm. British type. Native. Area general. Range 0-300. Frequent upon dry banks and about road-sides throughout the Lower Zone. Ascends Wensleydale to Hawes; *J. Percival. S. puberula* Jordan is not unfrequent.

Silene maritima With. British type. Native. Submaritime. Area 8 . 5 4. Range Coast-Level and 250-300. Rare with us as a maritime plant. It has been met with in Coatham Marshes and upon the sea-bank between Marske and Saltburn. Inland it grows upon the Red Scar near Downholme, where it

was originally found by James Ward, so that, like *Plantago maritima* and *Armeria*, it has a Montane superadded to a Maritime role of distribution.

Silene Otites L. Incognit. There is a specimen in the Middleton herbarium from East Moors near Castle Howard, but the plant has not been seen there recently.

Silene anglica L. English type. Colonist. Area 3 2 1. Range 0-100. This species has been found as a weed of cultivated fields near Terrington by R. Spruce; and at different times by T. J. and W. Foggitt and myself about Thirsk and Sandhutton, but it is much less frequent than the following. Very plentiful in corn-fields by the railway across Strensall Common; *A. R. Waller*. Abundant in sandy fields at Pilmoor; *W. Foggitt*.

Silene noctiflora L. English type. Colonist. Area 8 . 6 5 4 3 2 1. Range 0-150. Not unfrequent in cultivated fields at a low level. Richmond, Bedale, Thorpe Arch, Leckby, Redcar, Saltburn, Acomb, Thirsk, Wass, Bulmer, Castle Howard, Hutton Bushel, Strensall Common, etc.

Silene Armeria L. Alien. A casual straggler from garden cultivation. Bedale, Thirsk, Stockton Forest, etc. Indigenous in France and Germany.

Lychnis Flos-cuculi L. British type. Native. Area general. Range 0-400. Common in damp places amongst the vales and hills.

Lychnis diurna Sibth. British type. Native. Area general. Range 0-450. Common in shaded places, ascending in the West Swale district to Whitsundale scars.

Lychnis vespertina Sibth. = *L. alba* Mill. British type. Native. Area 8 7 6 5 4 3 2 1. Range 0-200. Common upon road-sides and in cultivated fields in the low country. A plant is not unfrequent which looks like a hybrid between this and the preceding.

Lychnis Githago Lam. British type. Colonist. Area general. Range 0-300. Frequent in cultivated fields, ascending in Swaledale to Muker.

Sagina procumbens L. British type. Native. Area general. Range 0-800. Common upon walls, road-sides and in damp places, ascending to the Main Limestone of Mickle Fell.

Sagina maritima Don. British type. Native. Maritime. Area 5. Range Coast-Level. Amongst the Coatham salt-marshes, and in dry sandy ground in the same neighbourhood.

Sagina apetala L. English type. Native. Area general. Range 0-300. Common upon walls and in dry places throughout the Lower zone, ascending to the flagstone quarries of Leyburn Moor.

Sagina ciliata Fries. English type. Native. Area 7 6. 3 2. Range 0-300. In similar situations to the preceding, but very rare. Sparingly with *Ornithopus* in the lane leading from Acomb towards the Ouse. Amongst the flagstone quarries over Leyburn Shawl; *F. A. Lees.* On a wall at Thirsk; *W. Foggitt.* The Acomb plant is more robust in its habit of growth than Jordan's figure and my continental specimens of *S. patula*, but I do not think it is essentially distinct. M. Boreau refers it to *S. ambigua* Lloyd. Dr. Carrington sends from Scarborough what appears to be the normal plant.

Sagina subulata Wimm. Scottish type. Native. Area 3. Range 150. This species has been reported to me as having been found on Hutton Bushel Moor by Messrs. Jobson and Deane of Hutton Bushel.

Sagina nodosa Meyer. British type. Native. Area general. Range 0-600. Found in all the districts and with a wide vertical range, but yet not anywhere plentiful. Amongst the western hills it grows principally in swamps and about the streams. It ascends to the plateau of Cronkley Fell, and about as high on Widdale Fell, and descends with the Tees to Blackwell, the Swale to Catterick Bridge, and the Yore to Tanfield and Hutton Conyers. It occurs also in Skeeby Marsh and near Bedale, and is frequent amongst the sandy heaths of the Central Vale and Howardian tract, and grows also upon

the Hambleton Hills, Silpho Moor and the coast sand-hills at Coatham and Saltburn.

Spergula arvensis L. British type. Colonist. Area general. Range 0-350. Common in cultivated fields and waste ground, ascending as high as field-cultivation reaches.

Honckeneja peploides Ehrh. British type. Native. Maritime. Area 5 4 3. Range Coast-Level. Amongst the coast sand-hills common at Middlesbrough, Coatham and Redcar; rarer southward at Sandsend, Whitby and Scarborough.

Spergularia media Angl. British type. Native. Maritime. Area 5 4 3. Range Coast-Level. Plentiful among the salt-marshes at Middlesbrough and Coatham; and occurring also at Sandsend and by the side of the Esk at Whitby and on the north shore at Sandsend and Scarborough. Our plant is the *Lepigonum neglectum* of Kindberg. The true *L. marinum* I do not know as occurring within our limits.

Spergularia rubra St. Hilaire. British type. Native. Area 7 . 3 . 1. Range 0-200. Sandy heaths, rare. It has been met with upon Hutton Moor (between Ripon and Dishforth) Strensall Common, Yearsley Moor, and Hutton Bushel Moor near Hackness.

Arenaria serpyllifolia L. British type. Native. Area general. Range 0-650. Common upon dry banks, ascending to the Main Limestone of Askrigg Moor and Widdale Fell. This refers to *A. sphærocarpa* Tenore. *A. leptoclados* Gussone is frequent, occurring principally in sandy cultivated fields, and ascends to the flagstone quarries of Leyburn Moor (300 yards); and *A. Lloydii* Jordan grows upon the castle hill at Scarborough.

Arenaria tenuifolia L. English type. Native. Area 7 . 3. Range 100-300. In tolerable plenty in company with *Teesdalia* and *A. leptoclados* amongst the flagstone quarries of Leyburn Moor. The species is also reported by R. Teesdale from Barton Heights near Castle Howard.

Arenaria verna L. Intermediate type. Native. Montane. Subxerophilous. Area 9 8 7. Range 150-800. Frequent

amongst the western hills and dales, but although this is the case, it is quite absent from those which lie on the east of our Central Valley. It ascends to the Main Limestone of Mickle Fell and Widdale Fell, and is especially plentiful about the lead-mines of the western dales, as for instance those of Gunnerside Gill, Arkengarthdale, Woodhall and Preston-under-Scar. In Swaledale it descends to Reeth, and with *Viola lutea* to Applegarth. I have had the Continental *A. laricifolia* sent to me as *A. verna* localised from the Yore side at Hutton Conyers.

Arenaria trinervis L. British type. Native. Area general. Range 0-300. Frequent upon shaded banks, ascending in Teesdale to Mickleton, and in the Yore district to Counterside in Semmerdale.

Stellaria nemorum L. Scottish type. Native. Montane. Area 9 8 7 6 . 4 3 2. Range 50-400. Stream-sides and damp woods in the dales, one of the most frequent of the characteristically Montane species. In Teesdale it does not ascend above Winch Bridge, but it occurs not only in the main dale, but also in Balderdale and Gretadale, and lower down the Tees as far as Piercebridge, Croft, and Dalton. In Swaledale it grows in Applegarth Woods, and in the Yore district it ascends to the woods of Fossdale and Whitfield Gill, and descends the river to Tanfield. By the Wharfe side it grows near Thorp Arch; in the Central Valley at Kirklington; and on the east in Whitstoncliff and Coxwold Woods, in the dale of the Rye and in several stations in the Howardian tract. Esk Bank in Newbiggin Wood; *Dr. R. Braithwaite.* Its distribution is nearer to that of *Trollius* than any other species, and in their diffusion the two are only below *Myrrhis* and *Crepis paludosa* of the Montane species.

Stellaria media Vill. British type. Native. Area general. Range 0-650. Shaded and waste places, everywhere common except in the heathery tracts. The highest place in which I have seen it is near a shepherd's hut on the ridge that runs from

the peak of Nine Standards Rigg towards the source of the Swale; the next highest near a shooting box on the Main Limestone of Askrigg Moor. *S. neglecta* Weihe is frequent in shaded places. *S. Borœana* Jordan ! I have gathered in Coatham marshes, and a variety (var. *brachypetala MS.*) intermediate between this and typical *S. media* at Sowerby near Thirsk.

Stellaria Holostea L. British type. Native. Area general. Range 0-350. Common in shaded places, ascending in Swaledale to Keld, in Arkengarthdale to Shaw Wood.

Stellaria glauca With. English type. Native. Area 9 8 . 6 . 4 3 2 1. Range 0-150. Watery places, not unfrequent in the low country.

Stellaria graminea L. British type. Native. Area general. Range 0-500. Frequent in damp and shaded places, ascending to the edge of Askrigg Moor.

Stellaria uliginosa Murr. British type. Native. Area general. Range 0-800. Frequent in damp places, ascending to the peak of Lovely Seat and the Main Limestone of Mickle Fell.

Cerastium aquaticum L. English type. Native. Area 8 . 6 5 . 3 2 1. Range 0-100. Frequent in watery places in the Central Valley. Banks of the Tees, Swale, Wiske, Codbeck, Ouse, Foss, etc.

Cerastium glomeratum Thuill. British type. Native. Area general. Range 0-350. Frequent in grassy and cultivated places throughout the Lower Zone, ascending to Keld and the village of Cotterdale.

Cerastium triviale Link. British type. Native. Area general. Range 0-800. Grassy places, common, ascending to the peaks of Great Whernside and Nine Standards Rigg, and the Main Limestone of Mickle Fell.

Cerastium semidecandrum L. British type. Native. Area 8 7 6 5 4 3 2 1. Range 0-300. Not unfrequent in dry sandy ground throughout the Lower Zone. On the west it ascends to the flagstone quarries of Leyburn Moor and the

64.5

TRANSACTIONS OF THE YORKSHIRE NATURALISTS' UNION.
PART 14,
ISSUED TO MEMBERS FOR THE YEAR 1888.

Museum of Comparative Zoology
OCT 11 1945

THE

YORKSHIRE CARBONIFEROUS FLORA

BY

ROBERT KIDSTON, F.R.S.E., F.G.S.

CONTENTS.

Introduction	pp. 3— 5.
Table of Yorkshire Coal Measures	pp. 6— 7.
Bibliography	pp. 7—16.
Synopsis of Species	pp. 16—64.
Index	pp. 65—66.

LEEDS:
PRINTED FOR THE YORKSHIRE NATURALISTS' UNION
BY TAYLOR BROTHERS.

SEPTEMBER 1890.

Megaphyton ... ... p. 43
,, frondosum ... p. 43
Neuropteris ... ... p. 40
,, heterophylla ... p. 40
,, tenuifolia ... ... p. 41
,, rarinervis ... .. p. 41
,, gigantea ... ... p. 41
,, obliqua ... ... p. 42
,, scheuchzeri ... ... p. 42
,, osmundæ ... ... p. 42
Odontopteris ... ... p. 39
,, binervosa ... p. 39
,, britannica ... p. 39
,, sp.... ... ... p. 40
Oligocarpia ... ... p. 33
,, brongniarti ... p. 33
Palæostachya ... ... p. 24
,, pedunculata p. 24
,, gracillima ... p. 24
Pecopteris ... ... p. 36
,, miltoni ... ... p. 36
,, volkmanni ... p. 37
Pinnularia ... ... p. 64
,, prostrata ... ... p. 64
Polypterocarpus... ... ... p. 62
Renaultia ... ... p. 32
,, schatzlarensis ... p. 32
Rhabdocarpus ... ... p. 63
,, sulcatus ... p. 63
,, elongatus ... p. 63
Rhacophyllum ... ... p. 43
,, crispum v. lineare p. 43
Sigillaria ... ... p. 53
,, discophora ... ... p. 53
,, mamillaris ... ... p. 54
,, ,, v. vulgaris p. 55
,, scutellata ... ... p. 55
,, boblayi ... ... p. 55
,, ovata ... ... p. 56
,, sp. .... p. 56
,, deutschia ... ... p. 56
Sigillaria tessellata ... ... p. 57
,, elegans ... ... p. 57
,, sp. ... ... p. 57
Sigillariostrobus... ... ... p. 58
,, sp. ... ... p. 58
,, sp. ... ... p. 58
Sphenophyllum ... ... p. 25
,, cuneifolium ... ... p. 25
,, ,, v. saxifragæfolium p. 26
,, majus ... ... p. 26
,, cf. oblongifolium ... p. 27
,, myriophyllum ... p. 27
,, trichomatosum ... p. 27
Sphenopteris ... ... p. 28
,, obtusiloba ... p. 28
,, trifoliolata ... p. 28
,, latifolia... ... p. 28
,, acuta ... ... p. 29
,, spinosa... ... p. 29
,, cristata ... p. 29
,, crenata ... ... p. 30
,, höninghausi p. 30
,, laurenti ... p. 30
,, footneri ... p. 31
,, zobeli ... ... p. 31
,, sternbergi ... p. 31
,, sp. ... ... p. 32
Spiropteris ... ... p. 45
,, sp. ... ... p. 45
Stigmaria .. .. p. 58
,, ficoides ... ... p. 58
,, reticulata ... ... p. 58
Trigonocarpus ... ... p. 61
,, parkinsoni ... ... p. 61
,, ,, v. bockschiana p. 61
,, ,, v. amygdalæformis p. 61
,, oblongus ... ... p. 62
,, noeggerathi ... ... p. 62
,, ovatus ... ... p. 62
,, sp. .. .. p. 62
Urnatopteris ... ... p. 34
,, tenella ... ... p. 34

THE
YORKSHIRE CARBONIFEROUS FLORA.

ROBERT KIDSTON, F.R.S.E., F.G.S.

THE YORKSHIRE FOSSIL FLORA COMMITTEE.

At the twenty-sixth Annual Meeting of the Yorkshire Naturalists' Union, held at Malton, on Wednesday, the 7th of March, 1888, a Committee was appointed for the Investigation of the Fossil Flora of the County of York, consisting of the following members :—

Prof. W. C. Williamson, LL.D., F.R.S., Manchester, *Chairman.*

William Cash, F.G.S., &c., Halifax, *Hon. Secretary.*

Samuel A. Adamson, F.G.S., Leeds.

Thomas Hick, B.A., B.Sc., Owens College, Manchester.

Benjamin Holgate, F.G.S., Leeds.

Robert Kidston, F.R.S.E., F.G.S., Stirling.

Prof. Louis C. Miall, F.L.S., F.G.S., Leeds.

James Spencer, Halifax.

John Stubbins, F.G.S., F.R.M.S., Leeds.

William West, F.L.S., Bradford.

Museum of Comparative Zoology
OCT 11 1945
80424

THE CARBONIFEROUS FLORA OF YORKSHIRE.

FIRST REPORT

On behalf of the Yorkshire Fossil Flora Committee.

ROBERT KIDSTON, F.R.S.E., F.G.S.

This Committee was appointed at the Annual Meeting held at Malton, in March, 1888, but before any Report could be prepared, some time had necessarily to elapse for the collection and examination of specimens. In the case of the specimens collected prior to the formation of the committee, the majority of them are without any note as to the horizon from which they were derived, and even the locality, when stated at all, is in most cases very vague. Unfortunately these remarks apply to almost all the specimens in our Museums, hence the working out of the horizontal and vertical distribution of the Carboniferous Flora can only be done satisfactorily from new material.

This has delayed the first report, and though it contains the record of over one hundred species it must be regarded as only of a provisional nature. Continued research will doubtless much increase the number of species and also show a wider distribution of those already known. From want of collectors there are practically no records from many parts of the coal field, not that fossil plants do not occur in those areas, but simply that they have not been collected. The committee therefore earnestly request members who either possess fossil plants or know of any collections, to communicate with the secretary.

It is only by the united efforts of local naturalists that we can expect to acquire an intimate knowledge of the Yorkshire Carboniferous Flora. This will be apparent to anyone who has collected such fossils, for special opportunities, such as driving mines or sinking new shafts (when the best specimens are usually secured), can only be known to those resident in the district. Should anyone become aware of such operations, especially if he is unable to collect from the debris as it is brought to the surface, he would confer a great favour by kindly reporting to the Secretary, Mr. W. Cash, Halifax, whenever aware of such operations being carried on.

The committee most cordially thank the many workers who have already assisted them in their investigations, by submitting specimens for examination. Assistance has been received in this way from Mr. W. Cash, F.G.S., Mr. J. W. Davis, F.G.S., Mr. J. Spencer, and Mr. J. Binns, Halifax; Mr. B. Holgate, F.G.S., and Mr. Tindal, Leeds; Mr. Learoyd, F.G.S., Huddersfield; Mr. Gelder and Mr. Taylor, Barnsley; Mr. G. McMurtrie, lately of Rotherham; Mr. C. Bradshaw, Sheffield; and to the curators of the various public museums visited. We also thank Earl Fitzwilliam for kindly allowing his collection to be examined; and Mr. H. B. Hans Hamilton, Wentworth; Mr. W. A. Durnford, Elsecar; and Mr. G. Carr, Low Stubbin Colliery, Rawmarsh, for their co-operation. Above all are we indebted to Mr. W. Hemingway, Barnsley, by whom the greater part of the fossils that contribute to this report have been collected. Had the committee a few as able and ardent collectors as he, ere long we should have a very good knowledge of the Yorkshire fossil plants.

In this part of the report none of those species are included which are distinguished by characters derived from their internal organization, as these will be treated of separately. It may perhaps be well to state here that all the specimens from which the records have been made have been examined by my-

self, with the exception of the records taken on the authority of Artis, Brongniart, and Lindley and Hutton.

It is not our intention to enter largely into the geology of the area under consideration, but with the object of showing the relationship of the various *horizons* to each other, a vertical section is given, which is taken from the Geology of the Yorkshire Coal Field.*

In this section we have drawn the dividing line between the Middle and Lower Coal Measures at the *Elland Flagstone*. The members of the Geological Survey on the other hand draw the dividing line below the *Silkstone Coal*. There is no marked break in the series, but palæontological evidence is strongly in favour of drawing the dividing line at the *Elland Flagstone*, and this is the view taken by many of the Yorkshire Palæontologists. The section gives the names of the various coal seams and correlates the different names that had been applied to the same seam in different parts of the county before their identity was known. In explaining this section, the authors of the Geology of the Yorkshire Coalfield say:—'The main members of the Coal Measure group are shown in the following table. The names borne by coals and sandstones in different parts of the field are arranged as nearly as may be in geographical order, beginning on the left-hand side with the names current in the south-eastern districts. In the same way the average thickness in feet of the various groups on the south are given in the left-hand margin, and those in the north in the right-hand margin.'

Those interested in the geological structure of the county will find it fully explained in the work already referred to, in which a list of the books and papers relating to the geology of the Yorkshire Coal Field is also included.

* Memoirs of the Geological Survey of England and Wales. By A. H. Green and R. Russell, &c. London, 1878. Page 75.

TABLE OF THE YORKSHIRE COAL MEASURES.

? Upper Coal-Measures.

52. Red Beds with Coal Plants of Conisborough Pottery.

Middle Coal Measures.

51. Measures.
50. *Wickersley*, *Houghton Common*, and *Pontefract Rocks*.
49. Measures.
720 48. *Dalton*, *Brierly*, and *Ackworth Rocks*.
47. Measures containing many irregular Sandstones and thin Coals.
46. **Shafton** or **Nostel Coal.**
45. *Upper Chevet Rock*, or equivalent measures.
44. Measures with *Middle* and *Lower Chevet Rocks* and thin Coals. | Measures with **Sharlston Top, Low and Yard Coals.** | Measures. **Holywell Wood Coal.**
780 43. *Treeton Rock*, *Oaks Rock*, or equivalent measures. | Measures with *Houghton Rock*. **Houghton Coals.** | Measures with *Ackton Rock*. **Wheatworth Coal.** 500
42. Measures with **Newhill** or **Steam Coal** and **Swinton Pottery Coal.** | Measures. **Bateson's Bed.** | Measures with **Castleford Four-Foot Coal.**
41. *Woolley Edge Rock*, or equivalent measures.
40. **Ashton Common, Wath Wood, Woodmoor,** and **Wakefield Muck Coals.**

Wathwood Group.

39. Measures. **Foxearth Coal.** | Measures. **Two-foot Coal.** | Measures. **Cat Coal.**
Measures. **Sough** or **Yard Coal.** | Measures. **Abdy** or **Winter Coal.** | Measures. **Stanley Scale Coal.**
540 Measures. **Furnace Coal.** | Measures. **Beamshaw Coals.** | Measures. **Stanley Main Coal.** 430
Measures with *Kent's Thin Rock*.

Kent's Group.

38. **Kent's Thin Coal.**
Measures with *Kent's Thin Rock*. | ? Absent north of Wakefield.
High Hazles, Kent's Thick, and **Mapplewell Coals.**

37. Measures with **Barnsley Rider Coal,** and *Barnsley Rock*.
36 **Barnsley, Warren House,** and **Gawthorpe Coals.**
210 35. Measures with thin irregular Coals. - - - - - - 200
34. **Swallow Wood Coal, Netherton Coals, Haigh Moor Coal.**
33. Measures with *Birdwell* and *Thornhill Rocks*.
300 32. **Joan, Mitchell,** or **Parson's Coal.** 310
31. Measures with **Tankersley Ironstone.**
30. **Heward, Flockton Thick,** and **Adwalton Stone Coal.**

Flockton Group.

29. Measures.
28. Doubtful if represented south of Flockton. | **Flockton Thin Coal, Adwalton Black Bed, Middleton High Main** or **Forty Yards Coal.** 120 to 150
27. Measures.
240 26. **Fenton's Coal** and **Black Mine Ironstone.** | Wanting north of Dodworth.
25. Measures with *Park Gate Rock*. | Measures with *Birstal Rock*.
24. **Park Gate, Old Hards, Two Yards, Brown Metal,** and **Firthfield Coals.**

Silkstone Group.

23. Measures.
22. **Walker's** or **Thorncliffe Thin, Green Lane, Middleton Little,** and **Hard Band Coals.**
21. Measures.
20. **Swilley, New Hards,** and **Middleton Main Coals.**
300 19. Measures. 260
18. **Silkstone Four-foot, Wheatley Lime, Three Quarters,** and **Middleton Eleven Yards Coals.**
17. Measures with *Silkstone Rock*. | Measures with *Falhouse Rock*.
16. Measures with **Claywood Ironstone.**
15. **Silkstone, Blocking,** and **Barcelona Coals.**
210 14. Measures - - - - - - - - - - - - 170
13. **Whinmoor Group of Coals.** | **Beeston Coals.**
Measures with irregular Sandstone. | Measures with *Oakenshaw Rock*.
Penistone Flags.
630 12. **Grenoside Sandstone Coal.** 450 | **Crow Coal.** 330
Grenoside Sandstone. | Measures with **Low Moor Ironstone.**
Black Bed Coal.
Measures. | Measures with *Thick Stone*.
11. **Underclay** and **Thin Coal.** | **Better Bed Coal.**

TABLE OF THE YORKSHIRE COAL MEASURES *(continued)*.

Lower Coal Measures.	540		10. *The Elland Flagstone.*		360
			9. Measures with irregular Sandstones and thin Coals.		
	150	Ganister Group.	8. **The Ganister** or **Hard Bed Coal.**		30
			7. Measures.		
			6. **Clay** or **Middle Bed Coal.**		
			5. Measures with *Middle Rock*.		
			4. **Coking** or **Soft Bed Coal.**		
	120		3 *Crawshaw Sandstone* and *Soft Bed Flags*, or equivalent measures.		50
			2. Measures.		
			1. **Thin Coal** and **Underclay.**		
			Rough Rock.		

Before giving a synopsis of the species, we will first add a few remarks on the works and papers of previous writers on Yorkshire Coal Plants.

I. **On Fossil Reliquia of Unknown Vegetables in the Coal Strata.** — By the Rev. Henry Steinhauer. (Trans. Amer. Phil. Soc., 1818). In this paper the following Yorkshire specimens are described:—

Phytolithus verrucosus. P. 268, pl. iv., figs. 1—6.

'The specimens more immediately examined were found in the neighbourhood of Fulneck, near Leeds, or in the space included by the towns of Leeds, Otley, Bradford, Huddersfield, and Wakefield, but have also found it on the top of Ingleborough. . . . '

This is the well-known *Stigmaria ficoides*. His fig. 3 shews the termination of a root.

Phytolithus sulcatus. P. 277, pl. v, figs. 1—2.

That given at fig. 1 has been made the type of *Calamites steinhaueri* by Brongniart.* I believe, however, that *Calamites steinhaueri* is only a large basal portion of *Calamites suckowii* Bngt., and not a distinct species. Steinhauer's fig. 2 is also apparently referable to *Calamites suckowii*.

Phytolithus cancellatus. P. 280, pl. vi., figs. 2—6.

These figures represent more than one species of *Lepidodendron*.

*Hist. d. Végét. Foss., p. 135, pl. xviii., fig. 4. (Figure copied from Steinhauer).

Phytolithus parmatus. P. 286, pl. vi., fig. 1, pl. vii., fig. 1.

That on pl. vi. fig. 1 is a *Calamitina*, the *Cyclocladia major* Lindley and Hutton. The specimen figured on pl. vii. fig. 1 is a large specimen of *Sigillaria discophora.* I originally regarded this figure of Steinhauer as referable to *Lepidodendron veltheimianum*, but since working up the Yorkshire Fossil Plants, have seen many specimens from Low Moor (Low Moor and Shelf being Steinhauer's localities), all of which are referable to *Sigillaria discophora*, König sp.

Phytolithus reticulatus. P. 291 (not figured).

Low Moor and Shelf.

Phytolithus martini. P. 291 (not figured).

As he gives as a reference to this fossil Martin's Petrificata Derbiensia, pl. xiv, fig. 2 (1809), *Phytolithus martini* has been a Lepidodendroid branch.

Phytolithus transversus. P. 293, pl. v.. fig. 3.

This is a small fragment of Artisia.

Phytolithus dawsoni. P. 293, pl. i., fig. 7.

A decorticated *Sigillaria.*

Phytolithus tessellatus. P. 295, pl. vii., fig. 2.

A badly preserved specimen of *Sigillaria* which 'does duty' as the type of *Sigillaria tessellata*, but whose true characters can only be learnt from the figures of subsequent authors! especially from those of Brongniart, who is then practically author of the species.

II. **Antediluvian Phytology.**—By Edmund Tyrell Artis, London, 1825.* This work is entirely devoted to the description and figuring of Yorkshire Carboniferous Plants and contains twenty-four well-executed plates. Since this work was written much alteration has taken place in the opinions and classification of fossil botany. The plants figured by Artis are:—

* The Introduction bears the date of 1825, but the Title Page that of 1838.

Hydatica prostrata Artis, pl. 1.

This plate shows a calamite stem with the roots attached. It is now classed in the genus *Pinnularia* L. & H. In *Pinnularia* are most probably placed the roots and rootlets of many plants. Several authors refer to *Pinnularia* as the roots and rootlets of *Calamites* and some *Pinnularia* have such an affinity—but likely not all. There is a considerable difficulty in defining the species of *Pinnularia*, and I have usually been under the habit of including all the British forms under *Pinnularia capillacea* L. & H., but some botanists regard several species. The arrangement of the rootlets appears to be almost the only character one has for guidance, and this varies so much that great difficulties arise in defining species. In the plate there is shown a stem or rhizome of *Calamites*, and if this were sufficiently well preserved for specific identification, the whole specimen (including roots), would be named from it, but that not being the case, the stem is passed over and the roots are named, a very unsatisfactory mode of proceeding, but one which in the present state of our knowledge of fossil plants, and the desirability of having definite names for the fossils met with, must be occasionally adopted. We may therefore call this plant in the meantime *Pinnularia prostrata* Artis sp., from which the *Pinnularia capillacea* L. & H., can scarcely be separated.

Elsecar, near Wentworth.

Calamites ramosus Artis. Pl. ii.

Leabrook Quarry, near Wentworth.

Ficoidites furcatus Artis. Pl. iii and iii bis.

This is simply a specimen of *Stigmaria ficoides* but probably gives the first figure of the dichotomously divided rootlets (Pl. iii. bis, A. & B.).

Calamites approximatus Artis. Pl. iv.

This is not the plant generally regarded as the true '*approximatus*' but more probably a form of *Calamites*

varians and perhaps its var. *schützei* (=*Calamites schützei* Stur.).

Hober Quarry, near Wentworth.

Hydatica columnaris Artis. Pl. v.

I do not think this differs from the fossil given on pl. i. under the name of *Hydatica prostrata.*

Elsecar, near Wentworth.

Calamites pseudo-bambusia Artis. Pl. iv.

Probably also referable to one of the protean forms of *Calamites (Calamitina) varians*, but from such a specimen as that figured here satisfactory determinations are all but impossible.

Quarry at Leabrook, near Wentworth.

Filicites osmundæ Artis. Pl. vii.

Now the *Neuropteris osmundæ* Artis sp.

Elsecar.

Sternbergia transversa Artis. Pl. viii.

Pith casts of Cordaites stems.

Although this is the first description of these fossils, the genus *Sternbergia* had been previously employed (though this was evidently unknown to Artis), so Sternberg, to obviate the mistake, re-named these fossils Artisia.† The plant is therefore distinguished now as *Artisia transversa* Artis sp.

Leabrook Quarry.

Rhytidolepis fibrosa Artis. Pl. ix.

A decorticated *Sigillaria* which cannot be specifically determined.

Rawmarsh, near Rotherham.

Ficoidites verrucosus Artis. Pl. x.

The *Stigmaria ficoides* Sternb. sp.

Elsecar, near Wentworth.

---

† Sternberg. Ess. Fl. Mond. Prim., ii., fasc. 7-8, p 192, 1838.

Filicites trifoliolatus Artis. Pl. xi.

Now the *Sphenopteris trifoliolata* Artis sp.

'Elsecar New Colliery, in that part of the mine which is near Milton Furnace.'

Myriophyllites gracilis Artis Pl. xii.

Probably not distinct from *Pinnularia prostrata* Artis sp. Elsecar New Colliery.

Calamites dubius Artis. Pl. xiii.

Probably referable to *C. varians* Sternb.

Leabrook Quarry, near Wentworth.

Filicites miltoni Artis. Pl. xiv.

Now *Pecopteris miltoni* Artis sp.

'In that part of Elsecar New Colliery situated near Milton Furnace.'

Euphorbites vulgaris Artis. Pl. xv.

From the examination of several specimens of this plant, on some of which the leaf scars are much closer than on that figured by Artis, I believe it to be a variety of *Sigillaria mamillaris* Brongt. I therefore record it as *Sig. mamillaris* Bgt. var. *vulgaris* Artis sp.

Sandstone Quarry near Altofts, and Elsecar Coal Mine.

Aphyllum cristatum Artis. Pl. xvi.

Probably a badly preserved specimen of *Lepidodendron aculeatum* Sternb.

Quarry at Bank-top.

Filicites plumosus Artis. Pl. xvii.

Now *Dactylotheca (Pecopteris) plumosa* Artis sp.

Elsecar New Colliery.

Ficoidites major Artis. Pl. xviii.

Stigmaria ficoides Sternb. sp. A specimen with large root scars, but scarcely deserving varietal distinction.

Quarry near Rotherham and at Crudling near Stanley.

Lychnophorites superbus Artis. Pl. xix.

Probably a badly preserved specimen of *Lepidodendron aculeatum*. The enlargements A and B must not be relied on as they are evidently erroneous.

Swinton Common, near Rotherham.

Megaphyton frondosum Artis. Pl. xx.

Quarry near Rawmarsh.

Filicites decurrens Artis. Pl. xxi.

Now *Alethopteris decurrens* Artis sp.

Alverthorpe, near Wakefield, and near Leeds.

Carpolithus marginatus Artis. Pl. xxii.

Now *Cardiocarpus marginatus* Artis sp.

Leabrook Quarry.

Aphyllum asperum Artis. Pl. xxiii.

Most probably *Lepidodendron aculeatum* Sternb.

'In a continuation of the Elsecar nine feet coal [= Barnsley Thick Coal] situated near Hoyland.'

Calamites decoratus Artis. Pl. xxiv.

The lower portion of the stem of *Calamites suckowii* Bgt. Artis gives as a reference to his figure the plant figured by Steinhauer,† pl. v, fig. 1. Steinhauer's figure was subsequently named *Cal. steinhaueri* by Brongniart. I believe, however, that Artis is correct in uniting the plants.

III. **Histoire des Végétaux Fossiles.**—Vol. 1, 1832—37. Vol. 2 (incomplete), 1837—38. By A. Brongniart, Paris.

Several Yorkshire species are mentioned by Brongniart, most of them, however, on the authority of Artis. The species mentioned are :—

Calamites decoratus. Low Moor and Leabrook (Gallois and Artis).

Calamites ramosus. Low Moor and Leabrook (Artis).

Calamites dubius. Leabrook (Artis).

† Trans. Amer. Phil. Soc., 1818. Vol. i.

Calamites cannæformis (=*Calamites pseudo-bambusia* Artis). Leabrook (Artis).

Calamites approximatus. Hober Quarry, near Wentworth (Artis).

Calamites steinhaueri. Mines of Yorkshire (Steinhauer).

Sphenopteris tenella. Yorkshire (Dr. Taylor).

Sphenopteris trifoliolata. Elsecar (Artis).

Cyclopteris obliqua. Mines of Yorkshire (Greenough).

Neuropteris loshii. Low Moor.

Pecopteris miltoni. Elsecar (Artis).

Pecopteris plumosa. Elsecar (Artis).

Brongniart gives figures of *Calamites decoratus*, pl. xiv, figs. 1, 2 (copied from Artis); *Calamites dubius*, pl. xviii, figs. 1, 2 (copied from Artis); *Calamites approximatus*, pl. xv, figs. 7, 8 (copied from Artis); *Calamites steinhaueri*, pl. xviii, fig. 4 (copied from Steinhauer); *Sphenopteris tenella*, pl. xlix, fig. 1 (from a sketch communicated by Dr. Taylor); *Cyclopteris obliqua*, pl. lxi, fig. 3. He also reproduces, on his pl. xxi, fig. 4, under the name of *Calamites cannæformis*, one of the plants given by Steinhauer as *Phytolithus sulcatus* (pl. v, fig. 2).

The *Cyclopteris obliqua* is clearly to be referred to *Neuropteris osmundæ*, Artis sp.

It should be further noted that the figure of *Sphenopteris trifoliolata*, given by Brongniart on his pl. liii, fig. 3, is not Artis' plant, but the *Sphenopteris obtusiloba* Bngt. (=*Sph. irregularis* Sternb.), and also that the figures of *Pecopteris miltoni*, given in the Hist. d. Végét. Foss., pl. cxiv, figs. 1—7, are referable to *Pecopteris polymorpha*. Fig. 8 of the same plate has been excluded from this latter species by some authors and may belong to another plant. It has been named *Goniopteris brevifolia* by Schimper.† From the meagre data given by Brongniart's fig. 8, it is very

† Traité d. Paléont. Végét. Vol. i, p. 546.

difficult to determine the position of the specimen which Schimper has named *Goniopteris brevifolia*, but I have collected specimens at Radstock which do not appear to me to differ from Schimper's species (as far as I understand it), which are evidently referable to *Pecopteris miltoni*.

IV. **The Fossil Flora of Great Britain; or figures and descriptions of the vegetable remains found in a fossil state in this country.**—By Lindley & Hutton. Vol. i, 1831—33; vol. ii, 1833—35; vol. iii, 1835—37; London.

This work contains very few records of Yorkshire Coal Plants. The following are figured:—

Asterophyllites galioides. Vol. i, pl. xxv, fig. 2. 'Barnsley Coal Field.'

Lepidostrobus ornatus. Vol. i, pl. xxvi. 'Barnsley Coal Field.'

Halonia gracilis. Vol. ii, pl. lxxxvi. Low Moor.

Calamites verticillatus. Pl. cxxxix. From Hound Hill, near Pontefract.

Trigonocarpum oblongum. Vol. iii, pl. cxciiic. From Hound Hill, near Pontefract.

Calamites inequalis. Pl. cxcvi. From Sandstone Quarry east of Sheffield.

From the figure of *Calamites inequalis*, it is impossible to form any opinion of the value of this species, which appears to have been founded on a badly-preserved example.

On March 8, 1849, Mr. Henry Denny read a paper before the Geological and Polytechnic Society of the West Riding of Yorkshire, entitled 'A Glance at the Fossil Flora of the Carboniferous Epoch, with special reference to the Yorkshire Coal Field.' In it he figures a specimen of *Lepidophloios*, under the name of *Halonia tuberculosa*, shewing the bifurcation of the stem and the Halonian branches attached.

More recently this specimen has been figured by Prof. Williamson in his twelfth memoir "On the Organization of the Fossil Plants of the Coal Measures."†

† Phil. Trans., 1883. Pl. xxxiv.

In his various memoirs, Prof. Williamson figures and describes many Yorkshire specimens shewing their internal organization. Messrs. Cash & Hick have also contributed papers on the structure of some of the Yorkshire Coal Plants.

These papers will be treated of more fully in that part of the report dealing with such specimens.

Yorkshire has long been famous for the excellent specimens of *Stigmaria* which have been discovered during quarrying and other operations.

One such discovery is described by Dr. H. C. Sorby in a paper "On the Remains of a Fossil Forest in the Coal Measures at Wadsley, near Sheffield,"‡ and another account of a similar but better known discovery was that made at the quarries of Messrs. John Murgatroyd & Sons at Clayton near Bradford, in July, 1886, which has been described, along with other discoveries of a similar nature, by Mr. S. A. Adamson, F.G.S., in a paper "On Recent Discoveries of Carboniferous Vegetation in Yorkshire."†

The finest of the Clayton *Stigmariæ* has been figured by Prof. Williamson in his "Monograph on the Morphology and Histology of *Stigmaria ficoides*."* This specimen is now in Owens College, Manchester.

In 1877, the North of England Institute of Mining and Mechanical Engineers published a volume of "Illustrations of Fossil Plants: being an Autotype reproduction of selected drawings, prepared under the supervision of the late Dr. Lindley and Mr. W. Hutton, between the years of 1835 and 1840, and now for the first time published."

This work contains only one Yorkshire record:—

Asterophyllites sp. Pl. iv. Low Moor. Perhaps this is the *Asterophyllites roehli* Stur.

‡ Quart. Journ. Geol. Soc., 1875, p. 458.

† See also Brit. Assoc. Report, 1886, p. 628, and Quart. Journ. Geol. Soc., vol. xliv, p. 375; 1888.

Palæont. Soc., 1887. Pl. xv.

[NOTE.—In the record of species in this Report, the value of most species depends on characters derived from the form and arrangement of its various parts, whichfrom the present state of our knowledge seem to indicate differences between the various individuals recorded. Future investigations may show that many of the species recorded are only different parts or conditions of the same plant—but for the purposes of recording and comparing the species of one district with those of other areas—definite names must be applied to definite forms].

SYNOPSIS OF SPECIES.

CALAMARIÆ.

CALAMITES SUCKOW.

GROUP I.—CALAMITINA WEISS.

Calamitina (Calamites) varians Sternb.

Calamites varians Sternb. Vers. ii, p. 50, pl. xii.

MIDDLE COAL MEASURES.

Hor.—*Upper Chevet Rock.* Loc.—Quarry, Darfield, near Barnsley (Hemingway).

Hor.—*Woolley Edge Rock.* Loc.—Barnsley, common (Hemingway).

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Col., Darton, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford.

Calamitina (Calamites) göpperti Ett.

Calamites Göpperti Steinkf. v. Radnitz., p. 27, pl. 1, figs. 3—4.

Calamitina Göpperti Weiss, Steinkohlen Calamarien I, p. 127, pl. xvii, figs. 1—2.

Calamites (Calamitina) varians abbreviatus Weiss, ibid., vol. ii, p. 73, pl. xvi a, figs. 10—11.

Calamites (Calamitina) varians inconstans Weiss, ibid., vol. ii, pp. 62 and 69, pl. xvi a, figs. 7, 8; pl. xxv, fig. 2.

Calamophyllites Goepperti Zeiller. Flore foss. d. bassin houil. d. Valen. p. 363, pl. lviii, fig. 1.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

LOWER COAL MEASURES.

Hor.—*Elland Flagstones.* Loc.—Northowram, near Halifax. (Halifax L. and P. Society.)

REMARKS.—This species (under the name of var. *inconstans*, which does not differ from *Calamites göpperti* Ett.) has been treated by Weiss as a variety of *Calamites varians*, Sternb. Zeiller on the other hand regards it as a distinct species, and this opinion is adopted here. Although Calamites are such common fossils, the group to which this species belongs, viz.:—those with periodic whorls of large disc-like scars, is by no means well-known, so all such specimens should be most carefully preserved.

Calamitina verticillata L. and H. sp.

Calamites verticillatus L. and H., Fossil Flora, vol. ii, p. 159, pl. cxxxix.

MIDDLE COAL MEASURES.

Hor.—*Houghton Common Rock.* Loc.—In the Sandstone Rock of Hound Hill, near Pontefract.

REMARKS.—I have not met with any specimens that could be referred to this species. The authors of the Fossil Flora say, 'It is different from any species that has yet been met with on account of its distinct whorls of large deep scars. . . .' Unfortunately this character is not alone sufficient to distinguish this species from others now known, and I must confess that I have a difficulty in understanding what are the characters by which *C. verticillata* L. and H. sp. is to be distinguished from certain other forms. Additional specimens of this plant are therefore very desirable, and if possible from the original locality.

GROUP II.—EUCALAMITES WEISS.

Eucalamites ramosus Artis sp.

Calamites ramosus Artis, Antedil. Phyl. pl. ii.

Calamites nodosus L. and H., Fossil Flora, vol. i, pl. xv, (in part).

Calamites (*Eucalamites*) *ramosus* Weiss, Steinkohlen-Calamarien, part ii, p. 98, pl. ii, fig. 3; v, figs. 1, 2; vi; vii, figs. 1, 2; viii, figs. 1, 2, 4; ix, figs. 1, 2; x, fig. 1; xx, figs. 1, 2.

Foliage:—*Annularia radiata* Brongt., Prodrome, p. 156.

Middle Coal Measures.

Hor.—*Houghton Common Rock.* Loc.—Brierley, near Barnsley (Hemingway).

Hor.—*Woolley Edge Rock.* Loc.—Dove Cliff, near Barnsley (Hemingway).

Hor.—*Winter Coal.* Loc.—Wheatley Wood Colliery, near Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

Hor.— ? Loc.—Lea Brook Quarry, near Wentworth (Artis, type).

Remarks.—The right hand branch on Lindley and Hutton's pl. xv, fig. 2 of the same plate, as well as their pl. xvi, do not belong to *C. ramosus* (= *C. nodosus* L. and H.). These figures which so long have done duty as the foliage of this Calamite, have been found on more careful examination to be spikes of cones, whose position in regard to the stem on pl. xv, fig. 1 is merely accidental. This supposed foliage of *Calamites ramosus* is really a spike of cones belonging to the genus *Palæostachya*. On the other hand the fruit of *Calamites ramosus* has been described by Weiss (l.c.), who has shown it to belong to the *Calamostachys-type* of cone. The species is frequent in the Yorkshire Coal Field, but many of the specimens examined had no definite locality.

Eucalamites cruciatus Sternbg. sp.

Calamites cruciatus Sternb., Vers. i, fasc. 4, p. xxvii, pl. xlix, fig. 5.

Calamites cruciatus Brongt., Hist. d. végét. foss. p. 128, pl. xix.

Calamodendron cruciatum Zeiller, Expl. carte géol. Fr., vol. iv., p. 152, pl. clxxiv, fig. 3.

Calamites (*Eucalamites*) *cruciatus ternarius* Weiss, Steink.-Calamarien, vol. ii, p. 112, pl. xiii, fig. 3.

Calamites (*Eucalamites*) *quaternarius* Weiss, ibid., p. 113, pl. xiii, fig. 1.

Calamites (*Eucalamites*) *senarius* Weiss, ibid., p. 114, pl. xiii, fig. 2.

Calamites (*Eucalamites*) *senarius* Kidston, Trans. Roy. Soc. Edin., vol. xxxiii, p. 340, fig. 1.

Calamites approximatus L. and H. (not Brongt.), Fossil Flora, vol. iii, pl. ccxvi.

Calamites alternans Germar & Kaulfuss, Nov. Act. Acad. Nat.-Curios., vol. xv., part ii, p. 221, pl. lxv., fig. 1.

Calamites (*Eucalamites*) *multiramis* Weiss, Steink.-Calam., vol. ii, p. 114, pl. x, fig. 2; pl. xii.

Calamites (*Calamodendron*) *cruciatus* Zeiller, Flore foss. d. bassin houil. d. Valen. p. 353, pl. lv. fig. 2.

Middle Coal Measures.

Hor.—*Upper Chevet Rock.* Loc.—Darfield, near Barnsley (Seal).

Remarks.—The specimen noted here was found by Mr. S. Seal, F.G.S., and reported by him to the Yorkshire Geological and Polytechnical Society as *Calamites mougeotii*. It contains ten scars on each verticil. The number of scars on each verticil differs considerably in different specimens.

Group III.—STYLOCALAMITES Weiss.

Stylocalamites suckowii Brongt. sp.

Calamites suckowii Brongt., Hist. d. végét. foss. p. 124 (pl. xiv. fig. 6 ?); pl. xv, figs. 1—6; pl. xvi, figs. 2, 3, 4 (fig. 1 ?).

Calamites suckowii Weiss, Steink.-Calam., part 1, p. 123, pl. xix, fig. 1, 1876; part 2, p. 129, pl. ii, fig. 1; pl. iii, figs. 2, 3; pl. iv, fig. 1; pl. xxvii, fig. 3, 1884.

Calamites decoratus Artis, Antedil.-Phyt., pl. xxiv.

Calamites decoratus Brongt. (in part), Hist. d. végét. foss., p. 123, pl. xiv, figs. 1, 2 (not figs. 3, 4).

Calamites steinhaueri Brongt., Hist. d. végét. foss., p. 135, pl. xviii, fig. 4.

Phytolithus sulcatus Steinhauer, Trans. Amer. Phil. Soc., 1818, p. 277, pl. v, figs. 1, 2.

Middle Coal Measures.

Hor.—*Upper Chevet Rock.* Loc.—Quarry, Darfield, near Barnsley (Barnsley Mus.).

Hor.—*Barnsley Thick Coal.* Loc.—Mount Osborne Colliery, near Barnsley (Hemingway).

Hor.—*Beeston Coal.* Loc.—Leeds (Holgate).

Hor.—*Ironstone Bed.* Loc.—Shelf, near Low Moor (Davis).

Hor.—*Black Bed Coal.* Locs.—Low Moor, near Bradford (Davis). Knostrop, near Leeds (Holgate).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford.

Hor.— ? Loc.—Lea Brook Quarry, near Wentworth (*Calamites decoratus* Artis).

Hor.— ? Loc.—Cowms, Lepton, near Huddersfield, (Learoyd).

Lower Coal Measures.

Hor.—*Flag Rock.* Loc.—Halifax (Davis).

Hor.—*Elland Flagstones.* Loc.—Northowram, near Halifax (Halifax L. & P. Soc.).

Millstone Grit.

Loc.—Cold Edge, near Halifax (Cash).

Stylocalamites undulatus Sternb. sp.

Calamites undulatus Sternb., Vers. i, fasc. 4, p. xxvi; Vers, ii, p. 47, pl. i, fig. 2 (pl. xx, fig. 8?). Brongt., Hist. d. végét.

foss., p. 127, pl. xvii, figs. 1—4. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 338, pl. liv., figs. 1 and 4.

Calamites decoratus Brongt. (not Artis) (in part), p. 123, pl. xiv, figs. 3, 4.

Calamites (Stylocalamites) suckowii var. *undulatus* Weiss, Steink.-Calam., part ii, pp. 129, 134, 135, pl. xvii, fig. 4.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Woolley Colliery, near Barnsley (Hemingway).

REMARK.—Several specimens have been found.

Stylocalamites cistii Brongt.

Calamites cistii Brongt., Hist. d. végét. foss., p. 129, pl. xx. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 342, pl. lvi, figs. 1, 2.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Stylocalamites schatzlarensis Stur.

Calamites schatzlarensis Stur, Die Calamarien der Carbonflora der Schatzlarer Schichten (Abhandl. d. K. K. Geol. Reichs. Band. xi, Abth. ii, Wien, 1887), p. 164, pl. i, figs. 1, 2; pl. xiii, figs. 10, 11; pl. xiv b, fig. 4.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Taylor).

REMARKS.—The only specimen collected agrees with the figures 1, 2 of Stur's plate i.

Stylocalamites approximatus Brongt.

Calamites approximatus Brongt. (in part), Hist. d. végét. foss., p. 133, pl. xxiv, figs. 2, 3, 4, 5.

MIDDLE COAL MEASURES.

Hor.—*Upper Chevet Rock.* Loc.—Darfield, near Barnsley (Gelder).

CALAMOCLADUS SCHIMPER.

Calamocladus equisetiformis Schloth. sp.

Calamocladus equisetiformis Schimper, Traité d. paléont. végét., vol. i, p. 324, pl. xxii, figs. 1, 2.

Asterophyllites equisetiformis Germar, Vers. v, Wettin u. Löbejun, p. 21, pl. viii.

Hippurites longifolia L. & H., Fossil Flora, vol. iii, pls. cxc and cxci.

Casuarinites equisetiformis Schloth, Flora d. vorwelt, p. 30, pl. i, figs. 1, 2 ; pl. ii, fig. 3.

Annularia calamitoides Schimper, Traité d. paleónt. végét., vol. i, p. 349, pl. xxvi, fig. 1.

MIDDLE COAL MEASURES.

Hor.—*Houghton Common Rock.* Loc.—Brierley Tunnel, near Barnsley (Hemingway).

Hor.—*Milton Field* or *Half Yard Coal.* Loc.—Monkey Island Pit, Wath, near Barnsley (Gelder).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Monckton Colliery, near Barnsley (Hemingway).

Hor.—*Silkstone Coal.* Loc.—Barrow Pit, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Calamocladus roehli Stur. sp.

Asterophyllites roehli Stur, Calamarien d. Carbon. Flora d. Schatzlarer Schichten, p. 209, pl. xiv, figs. 10, 11, 12, 13a, b, c; pl. xv b, fig. 3.

MIDDLE COAL MEASURES.

Hor.—*Houghton Common Rock.* Loc.—Brierley Tunnel, near Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway).

Calamostachys (roehli (?)).

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc. — Monckton Main Colliery, near Barnsley (Hemingway).

REMARK.—The small cones placed here I believe to be the fructification of *Calamocladus roehli* Stur sp.

CALAMOSTACHYS SCHIMPER.

Calamostachys cf. longifolia Weiss.

Calamostachys longifolia Weiss (? not Sternb.), Steinkohlen Calam., part i, p. 50, pl. x, fig. 1 (? not *Calamostachys longifolia* Weiss (Sternb. sp.) ibid., part ii, p. 171, pl. xx, fig. 6; pl. xxi, fig. 11).

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

REMARKS.—The small cones which I refer to *Calamostachys longifolia* Weiss, are all separated from their parent branches. The cones figured under this name by Weiss in vol. ii of his work, appear to belong to a different species from those given in his vol. i.

Calamostachys typica Schimper.

Calamostachys typica Schimper (in part), Traité d. paléont. végét., vol. i, p. 328, pl. xxiii, fig. 1 (? 2, 3, 4, ref. in part) vol. iii, p. 457.

Calamites communis Ett. (in part), Steinkf. v. Radnitz, p. 24, pl. viii, figs. 1 and 4.

Volkmannia elongata Roehl (not Presl.), Foss. Flora d. Steink. Form. Westphalens, p. 19, pl. vii, fig. 1.

Calamostachys ludwigi Weiss (not Carruthers), (in part), Steinkohlen Calmarien, vol. ii, p. 163, pl. xviii, fig. 2 (? not pl. xxii, figs. 1—8; pls. xxiii and xxiv).

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Taylor).

REMARKS.—Some authors (Schimper and Weiss) unite the cones figured by Ludwig* with this species. In fact, Schimper gives as the types of his *Calamostachys typica* the figures of Ettingshausen (l.c.) and those of Ludwig. I am not aware that in any of the specimens I have given as references and synonyms to *Calamostachys typica* has the structure or mode of attachment of the sporangia been observed. Hence I do not see on what grounds the originals of the figures I quote as references to *Calamostachys typica* can be associated with the specimens figured by Ludwig, whose specific characters are derived from internal organization and to whose plant Mr. Carruthers has given the name of *Volkmannia* (*Calamostachys*) *ludwigi*.† The specimens on which the Yorkshire record is made are merely impressions similar to those figured by Ettingshausen and the other authors noted above.

PALÆOSTACHYA WEISS.

Palæostachya pedunculata Williamson.

Palæostachya pedunculata Williamson in Weiss, Steinkohlen Calmarien, vol. ii, p. 182, pl. xx, fig. 7; pl. xxi, figs. 3, 4. Zeiller, Flore foss. d. bassin houil. d. Valenciennes p. 382, pl. lx, figs. 1, 2. Binney, Palæont. Soc., vol. xxi, p. 29, pl. vi, figs. 4 and 4 a.

Fruit of Asterophyllites, Williamson, Phil. Trans., clxxiv, pp. 57 and 79, pl. v, fig. 32.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Palæostachya gracillima Weiss.

Palæostachya gracillima Weiss, Steinkohl.-Calam., part ii, p. 184, pl. xviii, fig. 1, 1884. Kidston, Trans. Geol. Soc. Glasgow, vol. viii, p. 54, pl. iii, fig. 3.

* Calamiten-Früchte aus dem Spatheisenstein bei Huttigen an der Ruhr. Palæontographica, vol. x, p. 11, pl. ii.

† Journal of Botany, vol. v, 1867, p. 349.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

MACROSTACHYA SCHIMPER.

Macrostachya sp.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

ANNULARIA STERNBERG.

Annularia microphylla Sauveur.

Annularia microphylla Sauveur, Végét. foss. d terr. houil. de la Belgique, pl. lxix, fig. 6. Zeiller, Flore foss. d. bassin houil. de Valenciennes, p. 392, pl. lx, figs. 3, 4.

Annularia minuta Wood, Trans. Amer. Phil. Soc., vol. xiii, p. 347, pl. viii, fig. 2. Lesquereux, Coal Flora, vol. iii, p. 725, pl. xcii, fig. 8.

MIDDLE COAL MEASURES.

Hor.—*Houghton Common Rock.* Loc.—Brierley Tunnel, near Barnsley (Hemingway).

SPHENOPHYLLEÆ.

Sphenophyllum cuneifolium Sternb. sp.

Rotularia cuneifolia Sternb., Vers. i, fasc. 2. p. 33, pl. xxvi, figs. 4 a and 4 b.

Sphenophyllum cuneifolium (including var. *saxifragæfolium*) Zeiller, Flore foss. d. bassin houil. d. Valen. p. 413, pl. lxii, fig. 1; pl. lxiii, figs. 1—10.

Sphenophyllum erosum L. and H., Fossil Flora, vol. i, pl. xiii.

MIDDLE COAL MEASURES.

Hor.—*Milton Field or Half Yard Coal.* Loc.—Monkey Island Pit, Wath, near Barnsley (Gelder).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery,

near Barnsley (Hemingway.) Monckton Colliery, Darton, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Var. saxifragæfolium.

Rotularia saxifragæfolium Sternb., Vers. i, fasc. 4, p. xxxii, pl. lv, fig. 4.

Sphenophyllumerosum var. *saxifragæfolium* Coemans & Kickx, Bull. Acad. roy. Belgique, vol. xviii, p. 151, pl. i, fig. 6.

Sphenophyllum saxifragæfolium Zeiller, Végét. foss. d. terr. houil. p. 31, pl. clxi, figs. 3—6.

Middle Coal Measures.

Hor.—*Milton Field or Half Yard Coal.* Loc.—Monkey Island Pit, Wath, near Barnsley (Gelder).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Monckton Colliery, near Barnsley (Hemingway). Low Stubbin Colliery, Rawmarsh, near Rotherham (Carr).

Remarks.—Mr. Hemingway has collected fruiting specimens of this species, the first British ones I have seen.

Sphenophyllum majus Bronn.

Rotularia major Bronn. in Bischoff, Kryptog. Gewächse, p. 89, pl. xiii, figs. 2 a and 2 b.

Sphenophyllum majus Bronn, Leith. geognost. vol. i, p. 32, pl. viii, figs. 9 a and 9 b.

Sphenophyllum majus Zeiller, Flore foss. d. bassin houil. d. Valen., p. 420, pl. lxiv, figs. 1, 2.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

Note.—Not common and usually fragmentary.

Sphenophyllum cf. oblongifolium Germar, var.

Rotularia oblongifolia Germar, Nov. Act. Phys. med. Acad. Cæsar. Leop., vol. xv, part ii, 1831, p. 225, pl. lxv, fig. 1.

Sphenophyllites oblongifolius Germar, Vers. d. Steink. von Wettin u. Löbejun, heft ii, p. 18, pl. vii, fig. 3.

Middle Coal Measures.

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery Darton, near Barnsley (Hemingway).

Remarks.—The leaves of the specimens included here under the name of *Sphenophyllum oblongifolium* are much smaller than those of the plant figured by Germar, and the specimens unfortunately were very fragmentary, hence a satisfactory determination cannot be made.

Sphenophyllum myriophyllum Crépin.

Sphenophyllum myriophyllum Crépin, Notes paléophytologiques, Bull. Soc. roy. d. botan. d. Belgique, vol. xix., part ii, 14 Feb. 1880. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 422, pl. lxi, fig. 7; pl. lxii, figs. 1—4.

Middle Coal Measures.

Hor.— *Barnsley Thick Coal.* Loc. — Monckton Main Colliery, near Barnsley (Hemingway).

Sphenophyllum trichomatosum Stur.

Sphenophyllum trichomatosum Stur, Die Calamarien der Carbon. Flora der Schatzlarer Schichten (Abhandl. d. k. k. Geol. Reichsanst., vol. xi, part ii, p. 202), pl. xv, figs. 1—4, 1887.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Willow Bank Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

REMARKS.—This plant has as yet only been found in a very fragmentary state, rarely more than single verticils of leaves having been met with.

FILICACEÆ.

SPHENOPTERIS BRONGNIART.

Sphenopteris obtusiloba Brongt.

Sphenopteris obtusiloba Bgt., Hist. d. végét. foss., p. 204, pl. liii, fig. 2.*

Sphenopteris irregularis Sternb., Vers. ii, fasc. 5, 6, pl. ix, fig. 7.

Sphenopteris latifolia L. & H. (not Bgt.)., Fossil Flora, vol. iii, pl. clxxviii.

MIDDLE COAL MEASURES.

Hor.—*Haigh Moor Coal.* Loc.—Featherstone, near Pontefract (Gelder).

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Sphenopteris trifoliolata Artis sp.

Sphenopteris trifoliolata Brongt., Prodr., p. 51. Kidston, Trans. Roy. Soc. Edin., vol. xxxv, pp. 403—405.

Filicites trifoliolata Artis, Antedil. Phyt., pl. xi.

MIDDLE COAL MEASURES.

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Monckton Colliery, near Barnsley (Hemingway). Elsecar, near Barnsley (Artis).

REMARK.—The type of the species came from Elsecar.

Sphenopteris latifolia Brongt.

Sphenopteris latifolia Brongt., Hist. d. végét. foss., p. 205, pl. lvii, figs. 1—4 (excl. syn.).

Mariopteris latifolia Zeiller, Flore foss. d. bassin houil. d. Valen., p. 161, pl. xvii, figs. 1, 2; pl. xviii, fig. 1.

MIDDLE COAL MEASURES.

Hor.— ? Loc.—Low Moor, near Bradford (Spencer).

Sphenopteris acuta Brongt.

Sphenopteris acuta Brongt., Hist. d. végét. foss., p. 207, pl. lvii, fig. 5.

Mariopteris acuta Zeiller, Flore foss. d. bassin. houil. d. Valen., p. 164, pl. xviii, fig. 2.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

REMARK.—*Sphen. acuta* seems to be closely allied to the previous species.

Sphenopteris spinosa Göppert.

Sphenopteris spinosa Göpp., Genr. d. plant. foss., part 3-4, p. 70, pl. xii; Zeiller, Flore foss. d. bassin houil. d. Valen., p. 134, pl. xv, figs. 1—3.

Diplothmema spinosum Stur, Carbon. Flora, vol. 1, p. 312, pl. xxviii, figs. 7, 8.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

REMARKS.—Crépin * and Zeiller † regard *Sphenopteris palmata* Schimper ‡ as only a variety of this species.

Sphenopteris cristata Brongt.

Sphenopteris cristata Brongt., Hist. d. végét. foss., p. 356, pl. cxxv, figs. 4, 5.

MIDDLE COAL MEASURES.

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Hemingway).

---

* Notes Paléophytologiques, ii, Soc. Roy. d. Botan. d. Belgique, Bull., vol. xix, 13 Mar. 1880.

† L.c. p., 137.

‡ Traité d. paléont. végét., vol. i, p. 388, pl. xxviii, fig. 1.

Sphenopteris crenata L. & H.

Sphenopteris crenata L. & H. and *Schizopteris adnascens* L. & H., Fossil Flora, vol. ii, pls. c. and ci.

MIDDLE COAL MEASURES.

Hor.—*Winter Coal.* Loc.—Wheatley Wood Colliery, near Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

REMARKS.—Some very fine specimens have been collected. Dr. Stur * unites this species with *Aspidites silesiacus* Göppert. † Dr. Weiss, Berlin, has favoured me with specimens of this latter fern, which appears to be identical with *Pecopteris plumosa* Artis sp. This last-mentioned species, however, appears to me to be distinct from *Sphenopteris crenata.* The *Aphlebia* attached to the rachis of *Sphenopteris crenata*, to which Lindley and Hutton gave the name of *Schizopteris adnascens*, are not a distinct species but an integral part of the fern. Some of the specimens collected by Mr. Hemingway shew this character most beautifully. Somewhat similar *Aphlebia* occur on recent ferns, as *Alsophila capensis* J. Sm. ‡ and *Gleichenia gigantea* Wall. §

Sphenopteris höninghausi Brongt.

Sphenopteris höninghausi Brongt., Hist. d. végét. foss., p. 199, pl. lii.

MIDDLE COAL MEASURES.

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Sphenopteris laurenti Andræ.

Sphenopteris laurentii Andræ, Vorwelt. Pflanzen., p. 39,

* Stur. Jahrb. d. k. k. geol. Reichsanstalt, 1889, vol. xxxix, heft i, p. 5.

† Syst. fil. foss., p. 364, pls. xxvii and xxxix, fig. 1.

‡ See Hooker, Species Filicum, vol. i, p. 37.

§ Ibid., vol. i, p. 5, pl. iiiA.

pl. xiii, figs. 1—3. Zeiller, Flore foss. d. bassin. houil. d. Valen., p. 85, pl. vi, fig. 3; pl. ix, fig. 4.

Hapalopteris laurentii. Die Farne d. Carbon. Flora d. Schatz. Schichten, p. 36, pl. xliv, figs. 5, 6.

Sphenopteris stipulata Andræ (not Gulbier), Vorwelt. Pflanzen, p. 40, pl. xiii, fig. 4.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Sphenopteris footneri Marrat.

Sphenopteris footneri Marrat, Proc. Liverpool Geol. Soc., Session 1871—72, p. 101, pl. viii, figs. 2, 3, 1872; Kidston, Trans. Roy. Soc. Edin., vol. xxxv, p. 406, pl. ii, fig. 3.

Middle Coal Measures.

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). Fence Colliery, Treeton, near Rotherham (Sheffield Mus.).

Sphenopteris zobelii Göppert sp.

Hymenophyllites zobelii Göpp., Syst. fil. foss., p. 260, pl. xxxvi, figs. 3, 4.

Diplothmema zobelii Stur, Die Farne d. Carbon. Flora d. Schatzlarer Schichten, p. 332, pl. xxix, figs. 13, 14.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—Monckton Main Colliery, near Barnsley (Hemingway).

Sphenopteris sternbergi Ett. sp.

Asplenites sternbergii Ett., Steinkf. v. Radnitz., p. 42, pl. xx, figs. 2, 3, and (part of) 4.

Sphenopteris sternbergi Zeiller, Flore foss. d. bassin houil. d. Valen., p. 128, pl. ix, fig. 5; pl. xxxviii, fig. 6.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

Sphenopteris (allied to **furcata** Brongt.).

MIDDLE COAL MEASURES.

Hor.—*Stanley Main Coal.* Loc.—Wakefield.

REMARKS. — The specimens placed here are very fragmentary but shew indications of the fructification, which is situated at the extremities of the pinnule segments. The state of preservation of the fossils does not admit of any minute description of this interesting fructification. It is to be hoped that further collecting will reveal better-preserved examples.

RENAULTIA ZEILLER.

Renaultia schatzlarensis Stur sp.

Hapalopteris schatzlarensis Stur, Die Farne d. Carbon. Flora d. Schatzlarer Schichten, p. 58, pl. xxxix, fig. 7, and xl, figs. 1—6.

(?) *Sphenopteris (Hapalopteris) schützei* Kidston (not Stur), Trans. Geol. Soc. Glasgow, vol. viii, p. 57, pl. iii, fig. 5.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway).

REMARKS.—Some very fine fruiting specimens of Stur's *Hapalopteris schatzlarensis* have been collected by Mr. Hemingway. On some of these the structure of the sporangia is very clearly exhibited. The sporangia are oval exannulate, with walls composed of slightly elongated cells and are situated singly, or two or three together, at the extremities of the pinnule cutting. The fern must be placed in *Renaultia* as this genus was founded some months prior to *Hapalopteris* Stur.

I now think that the fern I identified with doubt, as *Sphenopteris schützei* Stur sp., from the Lanarkshire Coal

Field, should be referred to *Renaultia schatzlarensis*, but these two species appear to be very closely related.

CROSSOTHECA Zeiller.

Crossotheca schatzlarensis Stur sp.

Crossotheca schatzlarensis Kidston, Ann. and Mag. Nat. Hist., Ser. 6, vol. ii, p. 27.

Calymmotheca schatzlarensis Stur, Die Farne d. Carbon-Flora d. Schatzlarer Schichten, p. 265, pl. xxxviii, figs. 1, 2.

Crossotheca fimbriata Kidston, Ann. and Mag. Nat. Hist., Ser. 6, vol. ii, p. 23, pl. i, figs. 1—8.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Monckton Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

Remarks.—I have re-described and figured the fruit of this species in the Annals and Mag. Nat. Hist. (l.c.) from a fine series of specimens collected by Mr. Hemingway, from which it is seen that the plant does not belong to *Calymmotheca* but to the genus *Crossotheca*.

OLIGOCARPIA Göppert.

Oligocarpia brongniarti Stur.

Oligocarpia brongniarti Stur, Zur Morph. u. Syst. d. Culm u. Carbon Farne, p. 56, fig. 16; Stur, Die Farne d. Carbon-Flora d. Schatz. Schicht., p. 129, fig. 20; p. 131, pl. lvii, figs. 2, 3. (excl. syn.).

Sphenopteris (Oligocarpia) brongniarti, Zeiller, Flore foss. d. bassin. houil. d. Valen., p. 97, pl. xi, figs. 3—5.

Sphenopteris (Oligocarpia) formosa Zeiller (not Gutbier), Ann. Sc. Nat., sér. 6e, vol. xvi, pp. 190, 191, pl. x, figs. 8—12.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

REMARK.—Apparently rare in the Yorkshire Coal Field.

URNATOPTERIS KIDSTON.

Urnatopteris tenella Brongt. sp.

Sphenopteris tenella Brongt., Hist. d. végét. foss., p. 186, pl. xlix, fig. 1.

Sphenopteris sp. Lebour, Illustrations of Fossil Plants, pl. xxxix.

Eusphenopteris tenella Kidston, Proc. Roy. Phys. Soc. Edin., vol. vii, p. 129, pl. i, figs. 1—6.

Urnatopteris tenella Kidston, Quart. Journ. Geol. Soc., vol. xl, p. 594, 1882.

Loc.—Mines of Yorkshire (Brongniart).

REMARKS.—This species was described by Brongniart from a drawing sent him by Dr. Taylor, but the only locality given is Yorkshire. I have not yet met with any Yorkshire specimens of this fern, but it occurs in the Northumberland Coal Field and in some of the Scotch Coal Fields. As far as I am aware it has only been discovered in the Lower Coal Measures. The type is preserved in the British Museum, South Kensington. The fruit of this species was described by myself in 1882.

MARIOPTERIS ZEILLER.

Mariopteris muricata Schloth. sp.

Schlotheim, Flora d. Vorwelt, pl. xii, figs. 21 and 23, 1804.

Filicites muricatus Schloth., Petrefactenk., p. 409.

Pec. muricata Brongt., Hist. d. végét. foss., p. 352, pl. xcv, figs. 3, 4, pl. xcvii.

Mariopteris muricata Zeiller, Flore foss. d. bassin. houil. d. Valen., p. 173, pl. xx, figs. 1—4; pl. xxi, fig. 1; pl. xxii, figs. 1, 2; pl. xxiii, fig. 1 (includes varieties).

Middle Coal Measures.

Hor.—*Milton Field or Half Yard Coal.* Loc.—Monkey Island Pit, Wath, near Barnsley (Gelder).

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Gelder).

Hor.—*Barnsley Thick Coal.* Locs.—Mount Osborne Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Elsecar, near Barnsley (Durnford). Kilnhurst Colliery near Rotherham.

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Var. **nervosa** Bgt. (sp.).

Pec. nervosa Brongt., Hist. d. végét. foss., p. 297, pl. xciv; pl. xcv, figs. 1, 2. L. & H., Fossil Flora, vol. ii, pl. xciv; Zeiller (l. c.) (where a full list of references and syn. will be found).

Middle Coal Measures.

Hor.—*Houghton Common Rock.* Loc.—Brierley Tunnel, near Barnsley (Hemingway).

Hor.—*In sinking above the Thick Coal.* Loc.—Rosa Colliery, near Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Monckton Colliery, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Hor.—*Dewsbury Rock.* Loc.—Dewsbury Moor (Tindall).

Millstone Grit.

Loc.—Cold Edge, Halifax (Cash).

Remark.—Very common.

DACTYLOTHECA Zeiller.

Dactylotheca plumosa Artis sp.

Filicites plumosus Artis, Antedil. Phyt., pl. xvii.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Woolley Pit, Darton, near Barnsley (Hemingway). Elsecar, near Barnsley (Artis, type).

Hor.—? Loc.—Kirkheaton, near Huddersfield (Tindall).

Var. **dentata** Bgt. (sp.).

Pecopteris dentata Brongt., Hist. d. végét. foss., p. 346, pls. cxxiii-cxxiv.

Dactylotheca dentata Zeiller, Flore foss. d. bassin houil. d. Valen., p. 196, pl. xxvi, figs. 1, 2; pl. xxvii, figs. 1—4; pl. xxviii, figs. 4, 5 (includes variety *delicatula*).

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Var. **delicatula** Brongt. (sp.).

Pecopteris delicatula Brongt., Hist. d. végét. foss., p. 349, pl. cxvi, fig. 6.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—Monckton Main Colliery, near Barnsley (Hemingway).

Remarks.—The *Dactylotheca (Pecopteris) dentata* Bgt. I believe to be only a variety of *Dactylotheca plumosa* Artis sp. The fruit of the fern to which Brongniart gave the name of *dentata* has been described by Zeiller.

PECOPTERIS Brongt.

Pecopteris (Asterotheca) miltoni Artis sp.

Filicites miltoni Artis, Antedil. Phyt., pl. xiv.

Pecopteris miltoni Kidston, Trans. Roy. Soc. Edin., vol. xxxiii, p. 374.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Monckton Colliery, near

Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Elsecar, near Barnsley (Artis, type).

REMARKS.—The synonymy of this species has been fully entered into in the paper on the 'Fossil Flora of the Radstock Series' in the Trans. Roy. Soc. Edin. (l. c.).

Pecopteris volkmanni Sauveur.

Pecopteris volckmanni Sauveur, Végét. foss. des terr. houil. de la Belgique, pl. xlv, figs. 1, 2 (? 3, 4).

Pecopteris volkmanni Zeiller, Flore foss. d. bassin, houil. d. Valen., p. 204, pl. xxviii, figs. 1—3.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

REMARKS.—Very rare. Only a single specimen of this species has come under my notice.

ALETHOPTERIS STERNB.

Alethopteris lonchitica Schloth. sp.

Scheuchzer, Herb. diluv., p. 15, pl. i, fig. 4 (1709).
Schlotheim, Flora d. Vorwelt., pl. xi, fig. 22 (1804).

Filicites lonchiticus Schloth., Petrefactenk., p. 414 (1820).

Pecopteris lonchitica Brongt, Hist. d. végét. foss., p. 275, pl. lxxxiv, figs. 1—7; pl. cxxviii. L. & H., Fossil Flora, vol. ii, pl. cliii.

Alethopteris lonchitica Kidston, Trans. Roy. Soc. Edin., vol. xxxiii, p. 384.

MIDDLE COAL MEASURES.

Hor.—*Stanley Main Coal.* Loc.—Parkhill Colliery, Wakefield (Cash).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Low Stubbin Colliery, Rawmarsh, near Rotherham (Carr). Monckton Colliery, near Barnsley (Hemingway). Fence Colliery, Treeton,

near Rotherham (Sheffield Museum). Elsecar, near Barnsley (Durnford).

Hor.—*Milton Field or Half Yard Coal.* Loc.—Monkey Island Pit, Wath, near Barnsley (Gelder).

Hor.—*Beeston Coal.* Loc.—Near Leeds (Holgate).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Hor.?—Locs.—Clifton, near Halifax. Dewsbury Moor.

Millstone Grit.

Locs.—Cold Edge, Halifax (Cash). Holywell, near Halifax (Cash).

Note.—Very common and widely distributed.

Alethopteris decurrens Artis sp.

Filicites decurrens Artis, Antedil. Phyt., pl. xxi.

Pecopteris heterophylla L. & H., Fossil Flora, vol. i, pl. xxxviii.

Pecopteris mantelli Brongt., Hist. d. végét. foss., p. 278, pl. lxxxiii, figs. 3, 4; L. & H., Fossil Flora, vol. ii, pl. cxlv.

Alethopteris gracillima Boulay, Terr. houil. du nord de la France, p. 33, pl. ii, fig. 5.

Alethopteris decurrens Zeiller, Flore foss. d. bassin, houil. d. Valen., p. 221, pl. xxxiv, figs. 2, 3; pl. xxxv, fig. 1; pl. xxxvi, figs. 3, 4.

Middle Coal Measures.

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Hemsworth Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Fence Colliery, Treeton, near Rotherham (Sheffield Museum).

Hor.—*Parkgate Coal.* Loc.—Church Lane Colliery, near Barnsley (Hemingway).

Hor.—*Silkstone Coal.* Locs.—Church Lane Colliery, near Barnsley (Hemingway). Barrow Colliery, near Barnsley (Hemingway).

Hor. ?—Loc.—Alverthorpe, near Huddersfield (Artis, type).

NOTE.—A very common species.

Alethopteris valida Boulay.

Alethopteris valida Boulay, Terr. houil. du nord de la France, p. 35, pl. i, fig. 8; Zeiller, Flore foss. d. bassin, houil. d. Valen., p. 231, pl. xxxiii, figs. 1, 2; pl. xxxiv, fig. 1.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

NOTE.—Only one example has been met with.

ODONTOPTERIS BRONGT.

Odontopteris britannica Gutbier.

Odontopteris britannica Gutbier, Vers. d. Zwick. Schwarzk., p. 68, pl. ix, figs. 8—11; Weiss., Fossil Flora d. jüng. Stk. u. Roth., p. 45, pl. i, fig. 2.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

Odontopteris binervosa Achep.

Odontopteris binervosa Achepohl, Niederrh.-Westfäl. Steink., p. 118, pl. xxxvi, fig. 5.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—North Gawber Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Low Stubbin Colliery, Rawmarsh, near Rotherham (Carr).

REMARKS.—This species, though not very rare, and occurring in several of the English Coal-Fields, is seldom represented by large specimens.

Odontopteris, sp.

MIDDLE COAL MEASURES.

Hor. — *Barnsley Thick Coal.* Locs. — North Gawber Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway).

Hor.—*Silkstone Coal.* Loc.—Barrow Colliery, nr. Barnsley (Hemingway).

NEUROPTERIS BRONGT.

Neuropteris heterophylla Brongt.

Filicites (Neuropteris) heterophyllus Brongt., Class. d. végét foss., p. 33, pl. ii, fig. 6.

Neuropteris heterophylla Brongt., Hist. d. végét. foss., p. 243, pl. lxxii, fig. 2 ; pl. lxxi.

Neuropteris loshii Brongt., Hist. d. végét. foss., p. 242, pl. lxxii, fig. 1 ; pl. lxxiii.

Cyclopteris trichomanoides Brongt., Hist. d. végét. foss., p. 271, pl. lxi *bis*, fig. 4.

MIDDLE COAL MEASURES.

Hor.—*Houghton Common Rock.* Loc.—Brierley Railway Tunnel, near Barnsley (Hemingway).

Hor.— *Winter Coal (Shale immediately below the underclay).* Loc.—Pit, one mile south of Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Fence Colliery, Treeton, near Rotherham (Sheffield Mus.). Low Stubbin Colliery, Rawmarsh, near Rotherham (Carr). Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

Hor.— *White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Hor. ?—Loc.—Chapeltown, near Sheffield (Holgate).

REMARKS.—This is the most common species in the coal field, and on that account has not been carefully collected.

Neuropteris tenuifolia Schloth. sp.

Filicites tenuifolius Schloth., Petrefactenk., p. 405, pl. xxii, fig. 1.

Neuropteris tenuifolia Brongt., Hist. d. végét. foss., p. 241, pl. lxxii, fig. 3; Zeiller, Flore foss. d. bassin houil. d. Valen., p. 273, pl. xlvi, fig. 1.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

NOTE.—Very rare.

Neuropteris rarinervis Bunbury.

Neuropteris rarinervis Bunbury, Quart. Journ. Geol. Soc., vol. iii, p. 425, pl. xxii.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Kilnhurst Colliery, near Rotherham (Gelder).

Neuropteris gigantea Sternb.

Osmunda gigantea Sternb., Vers. i, fasc. 2, pp. 33 and 36, pl. xxii.

Neuropteris gigantea Sternb., Ibid., i, fasc. 4, pl. xvi; L. & H., Fossil Flora, vol. i, pl. lii; Brongt., Hist. d. végét. foss., p. 240, pl. lxix; Zeiller, Flore foss. d. bassin houil. d. Valen., p. 258, pl. xlii.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Neuropteris obliqua Brongt. sp.

Neuropteris obliqua Zeiller, Flore foss. d. bassin houil. d. Valen., p. 284, pl. xlviii, figs. 1, 2 (fig. 3?) figs. 4—7.

Pecopteris obliqua Brongt., Hist. d. végét. foss., p. 320, pl. xcvi, figs. 1—4.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Remarks.—Owing to the fragmentary condition of the specimens described by Brongniart, the true characters of this fern were not understood. His figures mostly shew terminal portions of pinnæ, where the pinnules in *Neuropteris* are generally united, to a greater or less extent, by their bases to the rachis, giving such specimens a Pecopteroid character. Excellent figures of *Neuropteris obliqua* are given by Zeiller.

This species appears to be rare in Yorkshire, the only specimens known to me being two small examples collected by Mr. Hemingway.

Neuropteris scheuchzeri Hoffm.

Neuropteris scheuchzeri Hoffm., Keferstein's Teuchland Geognostisch Geologisch Dargestellt, vol. iv, p. 156, pl. i *b*, figs. 1—4; Kidston, Trans. Roy. Soc. Edin., vol. xxxiii, p. 356, pl. xxiii, figs. 1, 2.

Middle Coal Measures.

Hor.—*Shale under Houghton Common Rock.* Loc.—Hull and Barnsley Railway, Brierley Common, near Barnsley (Hemingway).

Note.—Apparently very rare in Yorkshire.

Neuropteris osmundæ Artis sp.

Filicites osmundæ Artis, Antedil. Phyt., pl. vii.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery,

near Barnsley (Hemingway)' North Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery near Barnsley (Hemingway). Elsecar, near Barnsley (Artis, type).

Hor.—*Shale beneath underclay of Winter Coal.* Loc.—Pit, one mile south of Barnsley (Hemingway).

RHACOPHYLLUM Schimper.

Rhacophyllum crispum Gutb. sp. var. **lineare** Gutb. (sp.).

Rhacophyllum crispum Gutbier sp. var. *lineare* Gutbier sp. Kidston, Trans. Roy. Soc., Edin. Vol. xxxv, p. 410.

Fucoides linearis Gutb., Vers. d. Zwick. Scharzk. p. 13, pl. i, figs 10—12.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

Hor.—*Silkstone Coal.* Loc.—Barrow Colliery, near Barnsley (Hemingway).

SPIROPTERIS Schimper.

Spiropteris, sp.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

Remarks.—Under this name are placed circinately coiled up fronds, whose specific or generic position, owing to their undeveloped condition, cannot be determined.

MEGAPHYTON Artis.

Megaphyton frondosum Artis.

Megaphyton frondosum Artis, Antedil. Phyt., pl. xx.

Megaphyton approximatum L. & H., Fossil Flora, vol. ii, pl. cxvi.

Megaphyton distans L. & H., Fossil Flora, vol. ii, pl. cxvii.

Middle Coal Measures.

Hor.—*Woolley Edge Rock.* Loc.—Miss Bright's Quarry, Barnsley.

Hor.—*Barnsley Rock*?* Loc.—Quarry, near Rawmarsh (Artis, type).

NOTE.—Very rare. The counterpart of the type is preserved in the British Museum.

LYCOPODIACEÆ.

LEPIDODENDRON STERNB.

Lepidodendron dichotomum Sternb. (in part).

Lepidodendron dichotomum Sternb., Vers. i, fasc. i, pp. 19 and 23, pls. i and ii (not pl. iii); vers. ii, p. 177, pl. lxviii, fig. 1 (1820).

Lepidodendron Sternbergii Brongt., Prodrome, p. 85 (1828).

MIDDLE COAL MEASURES.

Hor.—*Woolley Edge Rock.* Loc.—Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Monckton Colliery, near Barnsley (Gelder).

Hor.—*Better Bed Coal.* Loc.—Clifton, near Halifax (Spencer).

LOWER COAL MEASURES.

Hor.—*Rag above Freestone.* Loc.—Northowram, near Halifax (Cash).

REMARKS.—*Lepidodendron dichotomum* Sternb. (=*Lepidodendron sternbergii* Brongt.) is frequently referred to as occurring in Britain, but when the matter is critically looked into, it is very difficult to ascertain what are the true characters of this species. Some authors regard *Lepid. ophiurus* Brongt. as a distinct species, but for my own part I am inclined to regard it as simply the younger branches of *Lepidodendron dichotomum.* From the examination of the specimens named *Lepidodendron sternbergii* in the

* Mr. Hemingway says in regard to the horizon of Artis' type specimen, The *Barnsley Rock* is well developed (90 ft.) at Rawmarsh where it is quarried. I have but little doubt as to this being the rock from which Artis obtained his type of *M. frondosum.*

'Hutton Collection,' and the evidence afforded by Lindley and Hutton's plate itself, I think there is no doubt that the fossil given by Lindley and Hutton (Vol. i, pl. iv) which they name *Lepidodendron sternbergii* is identical with *Lepid. ophiurus* Brongt. It is therefore very desirable that *Lepid. dichotomum* and *Lepid. ophiurus* (whether they form two species or are only different conditions of the same plant) should be carefully collected. In the meantime I treat them as distinct. They occur together in the same beds.

Lepidodendron ophiurus Brongt.

Sagenaria ophiurus Brongt., Class. d. végét. foss., p. 27, pl. iv, fig. 1 a, and 1 b.

Lepidodendron ophiurus Brongt., Prodrome, p. 85. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 458, pl. lxviii, figs. 1—6.

Lepidodendron gracile L. & H., Fossil Flora, vol. i, pl. ix. Brongt., Hist. d. végét. foss., vol. ii, pl. xv.

Lepidodendron dilatatum L. & H., Fossil Flora, vol. i, pl. vii, fig. 2.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—Fence Colliery, Treeton, near Rotherham (Sheffield Mus.). East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Rosa Colliery, Barnsley (Hemingway).

Hor.—*Silkstone Coal.* Loc.—Barrow Colliery, near Barnsley (Hemingway).

Hor.—*Ironstone Bed.* Loc.—Low Moor, near Bradford (Davis).

Hor.—*Black Bed Coal.* Loc.—Low Moor, near Bradford (Davis).

Lepidodendron obovatum Sternb.

Lepidodendron obovatum Sternb., Vers. i, fasc. i, pp. 20 and 23, pl. vi, fig. 1; pl. viii, fig. 1 a; fasc. iv, p. 10; Zeiller, Flore foss. d. bassin houil. d. Valen., p. 442, pl. lxvi, figs. 1—8.

Middle Coal Measures.

Hor.—*Swallow Wood Coal.* Loc.—Treeton, near Rotherham (McMurtrie).

Hor.—*Winter Coal.* Loc.—Winter Colliery, near Barnsley (Hemingway).

Hor.—*Silkstone Coal.* Locs.—Church Lane Colliery, Dodworth, near Barnsley (Hemingway). Rockingham, near Barnsley (Gelder).

Hor.—*Black Bed Coal.* Loc.—Low Moor, near Bradford (Davis).

Lower Coal Measures.

Hor.—*Soft Bed Coal.* Loc.—Sunny Bank, near Halifax (Cash).

Millstone Grit.

Loc.—Sowerby, near Halifax (Cash).

Lepidodendron aculeatum Sternb.

Lepidodendron aculeatum Sternb., Vers. i, fasc. 1, pp. 20 and 23, pl. vi, fig. 2; pl. viii, fig. 1*b*; Zeiller, Flore foss. d. bassin, houil. d. Valen., p. 435, pl. lxv, figs. 1—7.

Middle Coal Measures.

Hor.—*Upper Chevet Rock.* Loc.—Quarry, Darfield (Hemingway).

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Cash).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Low Stubbin Colliery, Rawmarsh, near Rotherham (Carr). Fence Colliery, Treeton, near Rotherham (Sheffield Mus.).

Hor.—*Ironstone Bed.* Loc.—Low Moor, near Bradford (Davis).

Lower Coal Measures.

Hor.—*Elland Rock.* Loc.—Northowram, Halifax (Spencer).

Hor.—*Flag Rock.* Loc.—Halifax (Davis).

Hor.—*Rag above Freestone.* Loc.—Hipperholme, near Halifax (Halifax L. & P. Soc.).

Millstone Grit.

Locs.—Barkisland, near Halifax (Halifax L. & P. Soc.). Hebden Bridge, near Halifax (Halifax L. & P. Soc.). Deep Clough, Luddenden Valley, near Halifax (Spencer). Upper Mill, Holmfirth, West Riding (Leeds P. & L. Soc.).

Lepidodendron haidingeri Ettingsh.

Lepidodendron haidingeri Ett., Steinkf. v. Radnitz., p. 55, pls. xxii, xxiii.

Sagenaria elegans Feistm. (neither Sternb. nor L. & H.), Vers. d. böhm. Ablager., ii Abth., 1875, p. 29, pl. viii, fig. 3.

Middle Coal Measures.

Hor.—*Stanley Main Coal.* Loc.—Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Loc.—Barrow Colliery, near Barnsley (Hemingway).

Lepidodendron haidingeri Zeiller (? not Ett.).

Lepidodendron haidingeri Zeiller (excl. ref. ?), Flore foss. d. bassin houil. d. Valen., pl. lxix, fig. 1.

Middle Coal Measures.

Hor.—*Silkstone Coal.* Loc.—Barrow Colliery, near Barnsley (Hemingway).

Remarks.—After the notes made by Zeiller (l.c., p. 403) on the specimen (No. 2773) from Radnitz, in the Muséum d'Histoire Naturelle and the example he has figured from Bully-Grenay under the name of *Lepidodendron haidingeri*, it is only with considerable diffidence I separate Zeiller's Bully-Grenay specimen from *Lepidodendron haid-*

ingeri Ett., but as the vascular scar on Zeiller's plant, both in its form and position, differs so much from Ettingshausen's figures and the British specimens of that species which I have previously examined, I can scarcely regard Zeiller's fossil as belonging to *Lepidodendron haidingeri* Ett.

Lepidodendron wortheni Lesqx.

Lepidodendron wortheni Lesqx., Geol. Survey of Illin., vol. ii, p. 452, pl. xliv, figs. 4, 5; Lesqx., Coal Flora, vol. ii, p. 388, pl. lxiv, figs. 8, 9; Zeiller, Flore foss. d. bassin, houil. d. Valen., p. 467, pl. lxxi, figs. 1—3; Kidston, Trans. Roy. Soc. Edin., vol. xxxiii, p. 394.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

REMARKS.—There appears to be two forms of this species, of which Lesquereux figures both in the Geol. Survey of Illin. and his Coal Flora. Of the two figures in the first-mentioned work, that on pl. xliv, fig. 4, represents the form found in the Upper Coal Measures of Radstock, while his fig. 5 shews that which occurs in the Middle Coal Measures of Yorkshire. Though a number of specimens have been examined from both these horizons, I have not yet found any intermixture of the two forms.

MACROSPORES.

REMARKS.—These occur in the shales at many horizons, but they have not yet been worked out.

LEPIDOPHLOIOS STERNB.

Lepidophloios laricinus Sternb.

Lepidodendron laricinum Sternb., Vers. i, fasc. 1, p. 23, pl. ix, figs. 2—4.

Lepidofloyos laricinum Sternb., Vers. i, fasc. 4, p. xiii.

MIDDLE COAL MEASURES.

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Hor.—*Black Bed Coal.* Loc.—Low Moor, near Bradford (Davis).

Lepidophloios acerosus L. & H. sp.

Lepidodendron acerosum L. & H., Fossil Flora, vol. i, pl. vii, fig. 1 ; pl. viii.

Lepidodendron brevifolium Ett., Steinkf. v. Radnitz, p. 53, pl. xxiv, figs. 4, 5 ; pl. xxv ; pl. xxvi, fig. 3.

Lepidostrobus pinaster L. & H., Fossil Flora, vol. iii, pl. cxcviii.

Lepidophloios laricinus Goldenberg (in part), Flora Saræpont. foss., heft. iii, p. 45, pl. xv, fig. 9 (named on plate *Lepidophloios macrolepidotus*).

Lepidodendron dichotomum Feist. (not Sternb.) (in part), Vers. d. böhm. Ablager., Abth. ii, p. 14, pl. iii, figs. 3—5.

(?) *Lepidodendron dichotomum* Roehl. (not Sternb.) (in part), Fossil Flora d. Steink. Form. Westph., p. 125, pl. xi, fig. 2.

Lepidophloios carinatus Weiss. Foss. Flora d. jüngst. Stk. u. Roth., p. 155 ; Kidston, Catal. Palæoz. Plants, p. 172.

MIDDLE COAL MEASURES.

Hor.—*Stanley Main Coal.* Loc.—Parkhill Colliery, near Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway).

REMARKS.—I have satisfied myself that the *Lepidodendron acerosum* L. & H. is a *Lepidophloios* and similar to the plants named *Lepidodendron brevifolium* Ett., to which Weiss applied the name of *Lepidophloios carinatus.* This species is distinguishable from *Lepidophloios laricinus* by its prominently keeled and *upward directed* leaf scars.

When small and imperfectly preserved specimens are met with, it is very difficult to separate the two species.

HALONIA L. & H.

Halonia sp.

MIDDLE COAL MEASURES.

Hor.—*Upper Chevet Rock.* Loc.—Quarry, Darfield (Hemingway).

Hor.—*Ironstone Bed.* Loc.—Low Moor, near Bradford (Davis).

LOWER COAL MEASURES.

Hor.—*Flag Rock.* Loc.—Swales Moor, Elland, near Halifax (Cash).

Hor.—? Loc.—Elland Edge, near Huddersfield (Learoyd).

REMARKS.—These are the fruiting branches of *Lepidophloios*, and when decorticated (as they are usually) it is impossible to determine the species to which they belong.

LEPIDOSTROBUS BRONGT.

Lepidostrobus variabilis L. & H.

Lepidostrobus variabilis L. & H., Fossil Flora, vol. i, pls. x—xi.

MIDDLE COAL MEASURES.

Hor.—*Better Coal Bed.* Locs.—Low Moor, near Bradford (Cash). Near Wyke Station (Cash).

LOWER COAL MEASURES.

Hor.—*Soft Coal Bed.* Loc.—Sunny Bank, Halifax (Cash).

NOTE.—Under this name are probably included the cones of several species.

Lepidostrobus lanceolatus L. & H. sp.

Lepidophyllum lanceolatum L. & H., Fossil Flora, vol. i, pl. vii, figs. 3, 4. Zeiller, Flore foss. d. bassin houil. d. Valen. p. 505, pl. lxxvii, figs. 7, 8.

MIDDLE COAL MEASURES.

Hor.—*Stanley Main Coal.* Loc.—Pit one mile west of Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

Lepidostrobus ornatus Brongt.

Parkinson, Organic Remains, pl. ix. fig. 1.

Lepidostrobus ornatus Brongt., Prodrome, p. 87. L. & H., Fossil Flora, vol. i, pl. xxvi; vol. iii, pl. clxiii.

Middle Coal Measures.

Hor.—*Crow Bed.* Loc.—Leeds (Holgate).

Remarks.—An imperfectly defined form—more probably representing a condition of preservation than a true species.

Lepidostrobus anthemis König sp.

Lepidostrobus anthemis Kidston, Catal. Palæoz. Plants, p. 197.

Conophoroides anthemis König, Icones foss. sectiles, pl. xvi, fig. 200.

Lepidostrobus radians Schimper, Traité d. paléont. végét., vol. ii, p. 63.

Lepidostrobus Brongt., Hist. d. végét. foss., vol. ii, pl. xxiii, fig. 6.

(?) *Lepidophyllum triangulare* Zeiller, Flore foss. d. bassin houil. d. Valen., p. 508, pl. lxxvii, figs. 4—6.

Middle Coal Measures.

Hor.—*Winter Coal.* Loc.—Winter Colliery, Smithies, near Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

Remarks.—These bracts vary a little in their outline, having sometimes slightly convex margins, at other times

they are slightly concave. I believe that Zeiller's *Lepidophyllum triangulare* should be referred to this species. The original of König's figure is preserved in the collection of the British Museum.

Lepidostrobus geinitzii Schimper.

Lepidostrobus geinitzii Schimper, Traité d. paléont. végét., vol. ii, p. 62 (excl. syn. *L. comosus* L. & H.). Zeiller, Flore foss. d. bassin houil. d. Valen., p. 501, pl. lxxvi, fig. 2.

Lepidostrobus variabilis Geinitz (not L. & H.), Vers. d. Steinkf. in Sachsen, p. 50, pl. ii, figs. 1, 3, 4. Roehl. (not L. & H.) (in part), Foss. Flora d. Steink. Form. Westph., p. 142, pl. vii, fig. 2. Feistmantel (not L. & H.) (in part), Vers. d. böhm. Ablager, part ii, p. 44, pl. xiv, pl. xv, figs. 1, 2.

Middle Coal Measures.

Hor.—*Black Bed Coal.* Loc.—Low Moor, near Bradford (Davis).

Lower Coal Measures.

Hor.—*Soft Coal Bed.* Loc.—Sunnybank, Halifax (Cash).

BOTHRODENDRON L. & H.

Bothrodendron minutifolium Boulay sp.

Bothrodendron minutifolium Zeiller, Flore foss. d. bassin houil. d. Valen., p. 491, pl. lxxiv, figs. 2—4. Kidston, Annals and Mag. Nat. Hist., 6th Ser., vol. iv, p. 64, pl. iv, figs. 5, 6.

Rhytidodendron minutifolium Boulay. Le terr. houil. du nord de la France et ses végét. foss., p. 39, pl. iii, figs. 1, 1 *bis*.

Lepidostrobus olryi Zeiller, Ibid., p. 502, pl. lxxvii, fig. 1.

Middle Coal Measures.

Hor.—*Stanley Main Coal.* Loc.—Parkhill Colliery, near Wakefield (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

REMARKS.—Stems, leafy branches and cones of this species have been collected. I described and figured the cone in the Ann. & Mag. Nat. Hist. for July, 1889, from a specimen collected at Monckton Main Colliery by Mr. Hemingway, on which the cone was seen attached to the parent stem. This specimen has also shewn that Zeiller's *Lepidostrobus olryi* is the fruit of *Bothrodendron minuti folium*.

LEPIDOPHYLLUM BRONGT.

Lepidophyllum majus Brongt.

Lepidophyllum majus Brongt., Prodrome, p. 87. Geinitz, Vers. d. Steinkf. in Sachsen, p. 37, pl. ii, fig. 5.

Lepidophyllum trinerve L. & H., Fossil Flora, vol. ii, pl. clii.

Lepidophyllum binerve Lebour, Illus. of Foss. Plants, pl. lii.

Lepidophyllum lanceolatum Lebour (not L. & H.), Illus. of Foss. Plants, pl. liii.

Glossopteris dubia Brongt., Class. d. végét. foss., p. 32, pl. ii, fig. 4.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

SIGILLARIA BRONGT.

Sigillaria discophora König sp.

Sigillaria discophora Kidston, Catal. Palæoz. Plants, p. 174. Kidston, Annals & Mag. Nat. Hist., 5th Ser., vol. xvi, p. 251, pl. iv, fig. 5; pl. v, fig. 8; pl. vii, figs. 12, 13. Kidston, ibid., 6th Ser., vol. iv, p. 61, pl. iv, fig. 1.

Ulodendron majus L. & H., Fossil Flora, vol. i, pl. v (excl. ref.).

Ulodendron minus L. & H., Ibid., vol. i, pl. vi (excl. ref.).

Lepidodendron discorphorum König, Icones foss. sectiles, pl. xvi, fig. 194.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—Monckton Colliery, near Barnsley (Hemingway).

Hor.—*Black Bed Coal.* Loc.—Low Moor, near Bradford (Davis).

Hor.—*Ironstone Bed.* Loc.—Low Moor, near Bradford (Davis).

Hor.—*Better Bed Coal.* Locs.—Low Moor, near Bradford (Cash). Near Wyke Station (Cash).

Lower Coal Measures.

Hor.—*Soft Bed Coal.* Loc.—Sunny Bank, near Halifax (Cash).

Millstone Grit.

Locs.—Kingcross, near Halifax (Halifax L. & P. Society). Nab End, Fly, near Halifax (Cash).

Remarks.—The systematic position of this fossil has been fully gone into in my two papers referred to above.

Sigillaria mamillaris Brongt.

Sigillaria mamillaris Brongt., Hist. d. végét. foss., p. 451, pl. cxlix, fig. 1 (? clxiii, fig. 1). Zeiller, Flore foss. d. bassin houil. d. Valen., p. 577, pl. lxxxvii, figs. 5—10.

Sigillaria dournaisii Brongt., Hist. d. végét. foss., p. 441, pl. cliii, fig. 5.

Sigillaria conferta Boulay, Terr. houil. du nord de la France, p. 44, pl. iii, fig. 1.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Mount Osborne Colliery, near Barnsley (Hemingway). Bellevue Colliery, near Barnsley (Hemingway).

Hor.—*Haigh Moor Coal.* Loc.—South Featherstone, near Pontefract (Hemingway).

Forma **vulgaris** (Artis sp.).

Euphorbites vulgaris Artis., Antedil. Phyt., pl. xv.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). Mount Osborne Colliery, near Barnsley (Hemingway). Elsecar, near Barnsley (Artis, type).

Hor.—? Loc.—Sandstone Quarry, near Altofts, near Wakefield (Artis).

Remark.—The *Euphorbites vulgaris* Artis appears to be only a form of *Sigillaria mamillaris* Brongt.

Sigillaria scutellata Brongt.

Sigillaria scutellata Brongt., Class. d. végét. foss., p. 22, pl. i, fig. 4. Brongt., Hist. d. végét. foss., p. 455, pl. cl, figs. 2, 3; pl. clxiii, fig. 3. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 533, pl. lxxxii, figs, 1—6, 9.

Sigillaria notata Brongt., Hist. d. végét. foss., p. 449, pl. cliii, fig. 1.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway).

Hor.—*White Rake Bed.* Loc.—Low Moor, near Bradford (Davis).

? **Sigillaria boblayi** Brongt.

Sigillaria boblayi Brongt., Hist. d. végét. foss., p. 446, pl. cliv. Goldenberg, Flora saræpont. foss., part ii, p. 37, pl. x, fig. 15. Zeiller, Flore foss. d. bassin houil. d. valen., p. 572, pl. lxxxiii, figs. 1—3.

Sigillaria elliptica var. *β.* Brongt., Hist. d. végét. foss., p. 447, pl. clii, figs. 1, 2.

Sigillaria hexagonalis, Achepohl, Niederrh.-Westfäl. Steink., p. 72, pl. xxi, fig. 10.

MIDDLE COAL MEASURES.

Hor.—*Alum Shale in Barnsley Thick Coal.* Loc.—Barnsley (Hemingway).

Sigillaria ovata Sauveur.

Sigillaria ovata Sauveur, Végét. foss. terr. houil. de la Belgique, pl. li, fig. 2. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 522, pl. lxxix, figs. 4—7 (3?).

Sigillaria essenia Achepohl, Niederrh.-Westfäl. Steink., p. 118, pl. xxxvi, fig. 9.

MIDDLE COAL MEASURES.

Hor.—In sinking shaft *over Stanley Main Coal.* Loc.—Pit one mile north of Wakefield (Hemingway).

Hor. —*Barnsley Thick Coal.* Locs. — North Gawber Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). Mount Osborne Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

Sigillaria sp.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Thrybergh Hall Colliery, four miles north of Rotherham (Bradshaw).

Sigillaria deutschi Brongt.

Sigillaria deutschi Zeiller, Flore foss. d. bassin houil. d. Valen., p. 554, pl. lxxx, figs. 6—8.

Sigillaria deutschiana Brongt., Hist. d. végét. foss., p. 475, pl. clxiv, fig. 3. Goldenberg, Flora saræpont. foss., heft ii, p. 47, pl. viii, fig. 16.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—(*Alum Shale*) East Gawber Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Platts Common, near Barnsley (Hemingway).

Sigillaria tessellata Steinhauer (Brongt.).

Phytolithus tessellatus Steinhauer, Trans. Amer. Phil. Soc., vol. i, p. 295, pl. vii, fig. 2.

Sigillaria tessellata Brongt., Hist. d. végét. foss., p. 436, pl. clxii, figs. 1—4. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 561, pl. lxxxv, figs. 1—9; pl. lxxxvi, figs. 1—6.

Middle Coal Measures.

Hor.—*Alum Shale in Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Hor.—? Loc.—Low Moor, near Bradford (Spencer).

Hor.—? Loc.—Flockton, near Wakefield (Tindall).

Millstone Grit.

Locs.—Nab End, Fly, near Halifax (Cash). Barkisland, near Halifax (Cash). Wheatley Valley, near Halifax (Spencer).

Note.—See remarks, ante, p. 8.

Sigillaria elegans Brongt. (Schl.).

Favularia elegans Sternb., Vers. i, fasc. 4, p. xiv, pl. lii, fig. 4

Sigillaria elegans Brongt., Hist. d. végét. foss., p. 438, pl cxlvi, fig. 1; pl. clv, ; pl. clviii, fig. 1. Zeiller, Flore foss. d. bassin houil. d. Valen., p. 582, pl. lxxxvii, figs. 1—4.

Sigillaria hexagona Brongt., Ibid., p. 458, pl. clviii, fig. 1.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—Wombwell Main Colliery, near Barnsley (Hemingway).

Hor.—*Silkstone Coal.* Loc.—Furnace Main Colliery, Cawthorn, near Barnsley (Hemingway).

Sigillaria sp.

Middle Coal Measures.

Hor.—*Black Bed Coal.* Loc.—Low Moor, near Bradford (Davis).

Hor.—? Loc.—Cinderfield, near Leeds (Tindall).

SIGILLARIOSTROBUS SCHIMPER.

Sigillariostrobus sp.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

Sigillariostrobus sp.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Monckton Main Colliery, near Barnsley (Hemingway).

STIGMARIA BRONGT.

Stigmaria ficoides Sternb. sp.

Variolaria ficoides Sternb., Vers. i, fasc. 1, pp. 22 and 24, pl. xii, figs. 1—3.

Stigmaria ficoides Brongt., Class. d. végét. foss., p. 28, pl. i, fig. 7. L. & H., Fossil Flora, vol. i, pls. xxxi—xxxvi.

NOTE.—Generally distributed throughout the various horizons.

Stigmaria reticulata Göpp.

Stigmaria ficoides var. *reticulata* Göpp., Gatt. d. foss. Pflanzen, Lief. 1, 2, p. 30, pl. ix, fig. 11.

MIDDLE COAL MEASURES.

Hor.—*Silkstone Coal.* Loc.—Furnace Main Colliery, Cawthorn, near Barnsley (Hemingway).

CORDAITEÆ.

CORDAITES UNGER.

Cordaites principalis Germar sp.

Flabellaria principalis Germar, Vers. d. Steink. v. Wettin u. Löbejun., p. 55, pl. xxiii.

Cordaites principalis Geinitz., Vers. d. Steinkf. in Sachsen, p. 41, pl. xxi. figs. 1, 2, 2*a*, 2*b*; (figs. 3—6 ?). Zeiller, Flore foss. d. bassin houil. d. Valen., p. 629, pl. xciii, fig. 3, pl. xciv, fig. 1.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—Woolley Colliery, Darton, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

LOWER COAL MEASURES.

Hor. — ? Loc. — Northowram, near Halifax (Halifax L. & P. Soc.).

ARTISIA STERNB.

Artisia Sternberg, 1838.

Sternbergia Artis (not Waldstein & Kitaibel), 1825.

Artisia transversa Artis sp.

Artisia transversa Sternb., Vers. ii, p. 192, pl. liii, figs. 7—9.

Sternbergia transversa Artis, Antedil. Phyt., pl. viii.

MIDDLE COAL MEASURES.

Hor.—*Upper Chevet Rock.* Loc.—Quarry, Darfield (Hemingway).

Hor.—*Barnsley Rock.* Loc.—Rotherham (Hemingway).

Hor.—*Woolley Edge Rock.* Loc.—Smithies, near Barnsley (Hemingway).

Hor.—*Houghton Common Rock.* Loc.—Brierley, near Barnsley (Hemingway).

Hor.—*Oaks Rock.* Loc.—Barnsley (Hemingway).

Hor.—*Parkgate Coal.* Loc.—Elsecar, near Barnsley (Durnford).

Hor.—*White Rake Rock.* Loc.—Low Moor, near Bradford (Davis).

Hor.— ? Loc.—Leabrook Quarry, near Wentworth (Artis).

MILLSTONE GRIT.

Locs.—Deep Clough Quarry, Halifax (Cash). Nab End, Fly, near Halifax (Cash).

CORDAIANTHUS GRAND'EURY.

Cordaianthus pitcairniæ L. & H. sp.

Antholithus pitcairniæ L. & H., Fossil Flora, vol. ii, pl. lxxxii.

Cardiocarpon lindleyi Carr., Geol. Mag., vol. ix, p. 55, figs. 1, 2.

Cardiocarpon acutum L. & H., Fossil Flora, vol. i, pl. lxxvi.
Cordaianthus pitcairniæ Zeiller, Flore foss, d. bassin houil. d. Valen., p. 639, pl. xciv, figs. 4, 5.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). Carlton Main Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

Cordaianthus volkmanni Ett. sp.

Cordaianthus volkmanni Zeiller, Flore foss. d. bassin houil. d. Valen., p. 637, pl. xciv, fig. 6.
Calamites volkmanni Ett. (in part), Steink. v. Stradonitz., p. 5, pl. v, figs. 1—3.
Antholithus pariflorus Schimper, Traité d. paléont. végét., vol. iii, p. 567, pl. cx, figs. 1—3.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Loc.—Woolley Colliery, Darton, near Barnsley (Hemingway).

CARDIOCARPUS BRONGT.

Cardiocarpus gutbieri Geinitz.

Cardiocarpus gutbieri Geinitz, Vers. d. Steinkf. in Sachsen, p. 39, pl. xxi, figs. 23—25.

MIDDLE COAL MEASURES.

Hor.—*Woolley Edge Rock.* Loc.—Dove Cliff, near Barnsley (Hemingway).

Cardiocarpus marginatus Artis sp.

Carpolithus marginatus Artis, Antedil. Phyt., pl. xxii, B. & C.

MIDDLE COAL MEASURES.

Hor.—? Loc.—Lea Brook Quarry, near Wentworth, near Barnsley (Artis, type).

TRIGONOCARPUS Brongt.

Trigonocarpus parkinsoni Brongt.

Trigonocarpus parkinsoni Brongt., Prodrome, p. 137.

Trigonocarpon naeggerathi L. & H. (not Sternb.), Fossil Flora, vol. ii, pl. xliic; vol. iii, pl. cxciii, figs. 1—4*b*; pl. ccxxii, figs. 2 and 4.

Trigonocarpon olivæforme L. & H., Fossil Flora, vol. iii, pl. ccxxii, figs. 1 and 3.

Carpolithus alatus L. & H., Fossil Flora, vol. ii, pl. lxxxvii; vol. iii, pl. ccx*b*.

Middle Coal Measures.

Hor.—*Woolley Edge Rock.* Locs.—Dove Cliff, near Barnsley (Hemingway). Smithies, near Barnsley (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). Carhouse Colliery, Rotherham (McMurtrie). East Gawber Colliery, near Barnsley (Hemingway).

Hor.—*Barnsley Rock.* Loc.—Rotherham (Gelder).

Hor.—*Haigh Moor Coal.* Loc.—Oulton, near Leeds (Holgate).

Forma **bockschianus.**

Rhabdocarpus bockschianus Göpp. & Berger, De fruct. et semin., p. 21, pl. i, figs. 13, 14.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—East Gawber Colliery, near Barnsley (Hemingway).

Forma **amygdalæformis** Gopp. & Berger.

Rhabdocarpus amygdalæformis Gopp. & Berger, De fruct. et semin., p. 21, pl. i, fig. 12.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway).

Trigonocarpus oblongus L. & H.

Trigonocarpum oblongum L. & H., Fossil Flora, vol. iii, pl cxciii*c*.

MIDDLE COAL MEASURES.

Hor.—? Loc.—Hound Hill, near Pontefract (L. & H., type).

Trigonocarpus noeggerathi Sternb. sp.

Trigonocarpus noeggerathi Brongt., Prodrome, p. 137. Kidston, Trans. Roy. Soc. Edin., vol. xxxv, No. 2, p. 414, pl. ii, fig. 4.

Palmacites noeggerathi Sternb., Vers. i, fasc. 4, p. xxxv, pl. lv, figs. 6, 7.

Palmacites dubius Sternb., Ibid., fasc. 4, p. xxxv, pl. lviii, figs. 3*a*, *b*, *c*, *d*.

MIDDLE COAL MEASURES.

Hor.—*Woolley Edge Rock.* Loc.—Dove Cliff, near Barnsley (Hemingway).

Hor.—*Upper Chevet Rock.* Locs.—Quarry, Darfield (Hemingway). Upper Cudworth, near Barnsley (Hemingway).

Trigonocarpus ovatus L. & H.

Trigonocarpum ovatum L. & H., Fossil Flora, vol. ii, pl. cxliii*a*.

MIDDLE COAL MEASURES.

Hor.—*Upper Chevet Rock.* Loc.—Quarry, Darfield, near Barnsley (Hemingway).

Hor.—*Woolley Edge Rock.* Loc.—Dove Cliff, near Barnsley (Hemingway).

Trigonocarpus sp.

MIDDLE COAL MEASURES.

Hor.—*Woolley Edge Rock.* Loc.—Dove Cliff, near Barnsley (Hemingway).

POLYPTEROCARPUS GRAND'EURY.

Flore carbonifère du departiment de la Loire et du centre de la France, p. 185.

Polypterocarpus sp.

MIDDLE COAL MEASURES.

Hor.—*Haigh Moor Coal.* Loc.—South Featherstone, near Pontefract (Hemingway).

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway.) Woolley Colliery, Darton, near Barnsley (Hemingway).

RHABDOCARPUS GÖPPERT & BERGER.

Rhabdocarpus sulcatus Presl., sp.

Carpolithus sulcatus Presl. in Sternb. (not L. & H.), Vers. ii, p. 208, pl. x, fig. 8.

MIDDLE COAL MEASURES.

Hor.—*Upper Chevet Rock.* Loc.—Darfield, near Barnsley (Hemingway).

Rhabdocarpus elongatus Kidston.

Rhabdocarpus elongatus Kidston, Trans. Geol. Soc. Glasg., vol. viii, p. 70, pl. iii, fig. 6.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). North Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway). Woolley Colliery, Darton, near Barnsley (Hemingway).

CARPOLITHUS STERNB.

Carpolithus inflatus Lesqx. sp.

Rhabdocarpus inflatus Lesqx., Coal Flora, vol. iii, p. 815, pl. cx, fig 36.

MIDDLE COAL MEASURES.

Hor.—*Barnsley Thick Coal.* Locs.—Monckton Main Colliery, near Barnsley (Hemingway). East Gawber Colliery, near Barnsley (Hemingway).

Carpolithus bivalvis Göpp.

Carpolithus bivalvis Göpp. & Berger, De fruct. et semin., p. 26, pl. ii, figs. 30, 31.

Carpolithus bivalvis Kidston, Trans. Geol. Soc. Glas., vol. viii, p. 71, pl. iii, fig. 7.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Locs.—East Gawber Colliery, near Barnsley (Hemingway). Monckton Main Colliery, near Barnsley (Hemingway).

Remarks.—The *Carpolithus perpusillus* Lesqx. (Coal Flora, vol. iii, p. 825, pl. cxi, figs. 22—24), if not similar to these little seeds, seems very closely related to them.

PINNULARIA L. & H.

Pinnularia prostrata Artis, sp.

Hydatica prostrata Artis, Antedil. Phyt., pl. i.

Hydatica columnaris Artis, Ibid., pl. v.

Note.—Generally distributed.

GNETACEÆ.

GNETOPSIS Renault & Zeiller.

Gnetopsis Ren. & Zeiller, Cours d. botan. foss., quatr. année 1885, p. 179.

Gnetopsis sp.

Middle Coal Measures.

Hor.—*Barnsley Thick Coal.* Loc.—Monckton Main Colliery, near Barnsley (Hemingway).

Note.—Genus now removed from the vegetable kingdom. It has been shewn by Renault and Zeiller, that the species of the curious genus *Palæoxyris* Brongt., whose systematic position has so long been enveloped in obscurity, are with little doubt the eggs of sharks (See 'Sur l'attribution des genres *Fayolia* et *Palæoxyris*'; Comptes rendus, 17 Dec. 1888).

INDEX.

Alethopteris ... ... p. 37
,, lonchitica ... p. 37
,, decurrens ... p. 38
,, valida ... ... p. 39
Annularia ... ... p. 25
,, microphylla ... p. 25
Artisia... ... ... p. 59
,, transversa ... ... p. 59
Bothrodendron ... ... p. 52
,, minutifolium p. 52
Calamites (Calamitina) ... p. 16
,, ,, varians ... p. 16
,, ,, göpperti ... p. 16
,, ,, verticillata... p. 17
,, (Eucalamites) ... p. 17
,, ,, ramosus ... p. 17
,, ,, cruciatus ... p. 19
,, (Stylocalamites) p. 19
,, ,, suckowii ... p. 19
,, ,, undulatus ... p. 20
,, ,, cistii ... ... p. 21
,, ,, schatzlarensis p. 21
,, ,, approximatus p. 21
Calamocladus ... ... p. 22
,, equisetiformis p. 22
,, roehli ... ... p. 22
Calamostachys ... ... p. 23
,, (?) roehli p. 23
,, cf. longifolia p. 23
,, typica ... p. 23
Cardiocarpus ... ... p. 60
,, gutbieri ... p. 60
,, marginatus... p. 60
Carpolithus ... ... p. 63
,, inflatus ... ... p. 63
,, bivalvis ... ... p. 64
Cordaianthus ... ... p. 59
,, pitcairniæ ... p. 59
Cordaianthus volkmanni ... p. 60
Cordaites ... ... p. 58
,, principalis ... ... p. 58
Crossotheca ... ... p. 33
,, Schatzlarensis p. 33
Dactylotheca ... ... p. 35
,, plumosa... ... ... p. 35
,, plumosa var. dentata p. 36
,, ,, var. delicatula p. 36
Gnetopsis ... ... p. 64
,, sp. ... ... p. 64
Halonia ... ... p. 50
Lepidodendron ... ... p. 44
,, dichotomum p. 44
,, ophuirus ... p. 45
,, obovatum... p. 46
,, aculeatum p. 46
,, haidingeri (Ett.) p. 47
,, ,, (Zeill.) p. 47
,, wortheni ... p. 48
Lepidophloios ... ... p. 49
,, laricinus ... p. 49
,, acerosus ... p. 49
Lepidophyllum ... ... p. 53
,, majus ... p. 53
Lepidostrobus ... ... p. 50
,, variabilis ... p. 50
,, lanceolatus... p. 50
,, ornatus ... p. 51
,, anthemis ... p. 51
,, geinitzii ... p. 52
Macrospores ... ... p. 48
Macrostachya ... ... p. 25
,, sp. ... ... p. 25
Mariopteris ... ... p. 34
,, muricata ... ... p. 34
,, ,, var. nervosa p. 35

[Continued on page 2 of wrapper].

PUBLICATIONS OF
THE YORKSHIRE NATURALISTS' UNION.

Complete, 8vo, Cloth, with Coloured Map, Price **One Guinea,** *post free,*

THE FLORA OF WEST YORKSHIRE. By FREDERIC ARNOLD LEES, M.R.C.S., etc.

This, which forms the 2nd Volume of the Botanical Series of the Transactions, is perhaps the most complete work of the kind ever issued for any district, including detailed and full records of 1,044 Phanerogams and Vascular Cryptogams, 11 Characeæ, 348 Mosses, 108 Hepatics, 258 Lichens, 1,009 Fungi, and 382 Freshwater Algæ, making a total of 3,160 species.

Complete, 8vo, Cloth, Price **6s.,** *post free.*

LIST OF YORKSHIRE LEPIDOPTERA. By GEO. T. PORRITT, F.L.S., F.E.S., etc.

This work, which forms the 2nd Volume of the Entomological Series of the Transactions of the Union, contains copious records of the localities, local variation, and other particulars concerning the 1,340 species of macro- and micro-lepidoptera known to inhabit the County of York.

In progress, issued in Annual Parts, 8vo.

TRANSACTIONS OF THE YORKSHIRE NATURALISTS' UNION.

The Transactions include papers in all departments of the Yorkshire Fauna and Flora, and are issued in separately-paged series, devoted each to a special subject. The Parts already published are sold to the public as follows (Members are entitled to special reduction): Part 1 (1877), 2/3; 2 (1878), 1/9; 3 (1878), 1/6; 4 (1879), 2/-; 5 (1880). 2/-; 6 (1881), 2/-; 7 (1882), 2/6; 8 (1883), 2/6; 9 (1884), 2/9; 10 (1885), 1/6; 11 (1885), 1/9; 12 (1886), 3/-; and 13 (1887), 3/-.

Second Edition of Baker's 'NORTH YORKSHIRE: Studies of its Botany, Geology, Climate, and Physical Geography.' This is being published in the Transactions, commencing in Part 11, and continued in Parts 12, 13, etc.

THE BIRDS OF YORKSHIRE. By WM. EAGLE CLARKE, F.L.S., M.B.O.U. Also being published in the Transactions.

Annotated List of the LAND and FRESHWATER MOLLUSCA KNOWN TO INHABIT YORKSHIRE. By JOHN W. TAYLOR, F.L.S., and WILLIAM NELSON. Also in course of publication in the Transactions.

THE YORKSHIRE CARBONIFEROUS FLORA. By ROBERT KIDSTON, F.R.S.E., F.G.S. Now in the Press, and to be followed by a paper by WILLIAM CASH, F.L.S., F.G.S.

MEMBERSHIP in the Yorkshire Naturalists' Union, 10/6 per annum, includes subscription to THE NATURALIST, and entitles the member to receive the current Transactions and to all other privileges of the Union.

Life Membership: FIVE GUINEAS.—Life Members receive on entrance the full set of publications quoted above.

Members are entitled to buy all back numbers and other publications of the Union at a discount of 25 per cent. off the prices quoted above.

All communications should be addressed to the Hon. Secretaries,

W. DENISON ROEBUCK, Sunny Bank, Leeds.

[REV.] E. PONSONBY KNUBLEY, Staveley Rectory, Leeds.

August, 1890.

THE NATURALIST, a Monthly Journal of Natural History for the North of England, edited by WM. DENISON ROEBUCK, F.L.S., with the assistance in Special Departments of J. GILBERT BAKER, F.R.S., W. EAGLE CLARKE, F.L.S., ALFRED HARKER, M.A., F.G.S., CHAS. P. HOBKIRK, F.L.S., GEORGE T. PORRITT, F.L.S., and W. BARWELL TURNER, F.C.S., F.R.M.S., 8vo, monthly, price 6d. (Annual Subscription, payable in advance, 5/- post free from the office only).

TRANSACTIONS OF THE YORKSHIRE NATURALISTS' UNION
PART 15,
ISSUED TO MEMBERS FOR THE YEAR 1889.

Museum of Comp. Zoology
OCT 11 19..
LIBRARY

(SECOND EDITION OF)

NORTH YORKSHIRE:

STUDIES OF ITS BOTANY, GEOLOGY, CLIMATE, AND PHYSICAL GEOGRAPHY,

BY

JOHN GILBERT BAKER, F.R.S., F.L.S.,

ROYAL HERBARIUM, KEW, EX-PRESIDENT AND PERMANENT VICE-PRESIDENT OF THE YORKSHIRE NATURALISTS' UNION.

CONTENTS

OF FOURTH INSTALMENT (FOUR SHEETS).

THE FLORA OF NORTH YORKSHIRE
(Cerastium to Pyrola) ... pp. 273—330

The next instalment will continue the Flora.

LEEDS:
PRINTED FOR THE YORKSHIRE NATURALISTS' UNION
BY TAYLOR BROTHERS.

NOVEMBER 1890.

64.5
Museum of Comparative Zoology
OCT 11 1945
LIBRARY
80424

Main Limestone of Leyburn Shawl. In the Central Vale it grows at Brompton-on-Swale, Topcliffe, and about the Stockton and Strensall Heaths; and in the Howardian tract at Yearsley and Terrington. In the Ainsty in sandy lanes about Poppleton and Acomb; *H. Ibbotson.* Sowerby Flats, Carlton Miniott, and other places near Thirsk; *W. Foggitt.* In Cleveland it is a plant of the basaltic dike and coast sand-hills.

Cerastium tetrandrum Curt. British type. Native. Maritime. Area 5 4. Range Coast-Level. With the preceding amongst the coast sand-hills at Coatham, Redcar, Marske, and Whitby.

Cerastium arvense L. British type. Native. Subxerophilous. Area 9 8 7 6 5 . 3 2 1. Range 0-250. Dry banks, one of the most frequent of the characteristically xerophilous species. Besides its stations amongst the lower levels of the calcareous tracts it is plentiful amongst the coast sand-hills, and occurs in many of the drier parts of the Central Vale, especially by the stream-sides, as for instance by the Tees between Croft and Dalton, the Swale at Sandhutton and Topcliffe, and the Ouse along Clifton Ings. It is allied in its distribution to *Anthyllis Vulneraria*, but does not ascend so high.

Linum usitatissimum L. Alien. Occasionally cultivated in the lower zone, and to be met with casually in a subspontaneous state. Linton-on-Ouse, the Lintune of the Domesday Book, is said to derive its name from the plant, so that it would seem that its growth is of ancient date.

Linum perenne L. Germanic type. Native. Xerophilous. Area 7. Range 250. In the Yore district on the western edge of Leyburn Shawl; *J. Ward*! Re-gathered by W. Horne in 1883. Reported also by R. Teesdale from fields at Bulmer.

Linum angustifolium Huds. Alien. Reported by W. Brunton from the neighbourhood of Malton, but not seen recently. A few plants on Stockton Forest in 1881; *A. R. Waller.*

Linum catharticum L. British type. Native. Area general. Range 0-700. Common upon sandy and grassy banks,

ascending to the Main Limestone of Booze Moor and Widdale Fell and the limestone edges of the northern slope of Mickle Fell.

Radiola Millegrana L. British type. Native. Area 7 . 3 2 1. Range 0-150. Frequent amongst the sandy heaths of the Central Vale and Howardian tract; Stockton Forest, Strensall Common, Hutton Moor, Coulton Moor, Terrington Carr, Pilmoor, etc. Also on walls at Thirsk, Romanby, and Coxwold.

Malva moschata L. British type. Native. Area general. Range 0-300. Not unfrequent upon dry banks throughout the lower zone. Croft, Cleasby, Ravensworth, Fremington, Applegarth Scars, Richmond, Preston Scar, Leyburn Shawl, Scarth Nick (1,000 feet), Middleham, Masham, Bedale, Leeming, Thorpe Arch, Hutton Rudby, Kilton, Castleton, Rosedale, Whitby, Thirsk, Castle Howard, Hovingham, Pickering, etc. The least plentiful of the three species in the low country, but yet with the widest vertical range.

Malva sylvestris L. British type. Native. Area general. Range 0-250. Common in waste ground and along road-sides, ascending to Kepwick, Carperby, and Leyburn, and grown in gardens up to 300 yards in the dales.

Malva rotundifolia L. English type. Native. Area general. Range 0-200. Frequent in similar situations to the preceding, ascending Wensleydale to Redmire.

Tilia parvifolia Ehrh. English type. Native. Area 3. Range 100-200. I have seen this species only in one place in an indigenous state, and that is at Slip Gill near Rievaulx, where aboriginal woods, composed principally of Oak and Hazel, cover the steeply-sloping rocky banks of one of the loneliest and pleasantest glens of the eastern calcareous range. As a planted tree it occurs within our limits occasionally, and *T. intermedia* as a planted tree is frequent. I have seen both of them up to 350 yards.

Tilia grandifolia Ehrh. English type. Native. Area 8. Range 100-250. Mr. Ward considers this species to be truly

indigenous amongst the limestone scars of the lower part of Swaledale. He writes—'The wood (where it occurs) near the Round Howe is a rocky wood and without any planted trees. At Clink Bank also it grows from the clefts of the rock in a very precipitous place, where no trees can well have been planted. In both places I should say that it is perfectly indigenous. Near the Round Howe it is plentiful. At Clink Bank there are three or four trees with innumerable young shoots growing from the bottom out of the rocks, and *Galium boreale* grows upon the rock within twenty yards of it.' As a planted tree the species is not unfrequent. It is recorded by R. B. Bowman from West Burton in Bishopdale, but the details respecting this station are not stated. There is a noble avenue of Limes in Thirkleby Park near Thirsk, which includes all the three species.

Hypericum Androsæmum L. English type. Native. Area 8 . 4 3. Range 0-100. Woods and hedge-banks in the low country, rare. In the Central Valley it grows in the neighbourhood of Sinderby, and in the lane between Mawnby and Kirkby Wiske. Near the Cleveland coast it grows at Kilton and in the woods of Larpool and Hawsker, and it has also been gathered by Reynolds near Hackness.

Hypericum perforatum L. British type. Native. Area general. Range 0-300. Common upon banks and along the sides of streams throughout the Lower Zone, ascending in Teesdale to Winch Bridge. The commonest species of the open low country.

Hypericum dubium Leers. British type. Native. Area 9 8 7 6 . 3. Range 0-400. In similar stations to the preceding, but much less frequent. Ascending in Teesdale to Middleton (*Flora*) and Cotterdale to 1,250 feet; *J. Percival.*

Hypericum quadrangulum L. = *H. tetrapterum* Fries. British type. Native. Area general. Range 0-400. Frequent in watery places amongst the vales and hills, ascending in the Yore district to Fossdale Woods and as high on Gayle Moss.

Hypericum humifusum L. British type. Native. Area general. Range 0-300. Frequent upon sandy and grassy banks

throughout the lower zone. Ascends to the Leyburn Flagstone Quarries; *J. Percival.*

Hypericum pulchrum L. British type. Native. Area general. Range 0-550. Frequent upon heathery banks from the vales upwards to the scars of Bleabeck and Cronkley. The commonest species of the heathery tracts.

Hypericum hirsutum L. British type. Native. Area general. Range 0-450. Frequent in woods and upon hedge-banks, ascending to the Main Limestone scars of Keld and Harlen Fell. The commonest species of the calcareous glens and dales.

Hypericum montanum L. English type. Native. Xerophilous. Area 6 . 3 2. Range 50-200. About the Magnesian Limestone at the quarry above Thorpe Arch. In the Vale of Mowbray between Coxwold and Thirkleby. Amongst the woods of the eastern calcareous range in several places; Flazendale, Beckdale, Hackness, etc., and in the Howardian tract in Hovingham and Gilla Leys Woods.

Hypericum elodes L. English type. Native. Area 4 3 2 1. Range 0-250. Frequent amongst the heaths of the Central Vale and Howardian tract; Pilmoor, Stockton Forest, Strensall Common, Scakleton Moor, Slingsby Moor, etc. Amongst the eastern arenaceous hills in Sleddale and Rosedale.

Hypericum calycinum L. Alien. Subspontaneous or planted in Cleveland in Mulgrave Woods; *W. Mudd*! In a small wood above Leyburn Shawl; *J. Percival* and *W. Foggitt.* Indigenous in Turkey.

Acer campestre L. English type. Native. Area general. Range 0-300. Frequent in woods and hedges, and occasionally, but not commonly, in the aboriginal woods of the calcareous hills. The highest place in which I have seen it is amongst the rocks at the foot of Whitstoncliff. Nappa Scar, Wensleydale; *J. Percival.*

Acer Pseudo-platanus L. Denizen. Area general. Range 0-450. The Coniferæ excepted, the Sycamore is the

commonest of the trees which are not clearly indigenous. If introduced its introduction must date back to a very ancient period. I have not heard that it has been met with in the post-glacial peat deposits,* but at the present day it is common both in the low country and amongst the hills. In both our eastern and western dales no tree is more frequent about villages and farm-houses. I have never seen it in any quantity in a clearly aboriginal wood, like the Ash, Oak, Birch, Hazel, Holly, Wych Elm, etc., or even like *Tilia parvifolia* in Slip Gill, but have often noticed a single tree or two or three trees in very wild-looking places, as for instance East Stonesdale Woods, and in Cliff Gill, where there were no houses within a considerable distance, and no other seemingly introduced trees or other plants near. Upon the whole I would say, that with us the Sycamore, like the Gooseberry-bush, and Cherry-tree, is very likely to be indigenous, but that I have not seen or heard of any evidence which shows conclusively that such is the case.

Erodium cicutarium L'Hérit. British type. Native. Area 8 7 6 5 4 3 2 1. Range 0-150. Frequent in sandy ground in the low country, both along the sea-coast and inland, ascending to Yearsley Moor.

Erodium moschatum L'Hérit. Atlantic type. Denizen? Area 3. Range 50. Waste ground at the road-side at Falsgrave near Scarborough; *H. Ibbotson*. I have not seen a specimen, and Bean does not know the station. A Native of the South of England.

---

* For an account of the old peat deposits of Holderness and Thorne Waste and the trees which they contain, reference may be made to Phillips' Yorkshire. They are evidently all of post-glacial date. Some of the Holderness deposits are below the present sea-level, but others must be referred to the Historic era. Respecting one of the deposits at Hatfield, Abraham De La Pryme writes in the Philosophical Transactions for 1701;—'Many of the trees have been burnt, sometimes quite through: others chopped, squared, bored through or split, * * and this at depths and under circumstances which preclude all supposition of their having been touched since the destruction of the forest.' The trees named by Phillips as found in them are Oak, Yew, Alder, Ash, Willow, Scotch Fir, Thorn, Hazel, Beech, and Birch.

Geranium phæum L. Alien. Subspontaneous in several places in the neighbourhood of parks and gardens. Aske, Kirklington, Swinton, Newton in Cleveland, Upsal, Feliskirk, Kilvington, Newburgh, Oldstead, Castle Howard, Strensall, etc. Indigenous in France and Holland.

Geranium nodosum L. Alien. Subspontaneous or planted in Aske woods; *J. Ward*: and in a wood near Kirklington; *M. Hebblethwaite!* Indigenous in France and Austria. The Italian *G. striatum* is also subspontaneous in Aske woods.

Geranium sylvaticum L. Scottish type. Native. Montane. Area 9 8 7 . 5 4 3. Range 100-550. Common in the woods and meadows of the western dales; ascending to Cronkley and White Force Scars, Ravenseat and Coverhead Falls, descending to Rokeby, Richmond and Wensley. Amongst the eastern hills in several places; Guisbrough, Kilton, Castleton, Mulgrave Woods, Helmsley, etc. Not known at all as a plant of the vales.

Geranium pratense L. British type. Native. Area general. Range 0-400. Frequent in fields and by the side of streams, ascending in Teesdale to the falls of Blea Beck.

Geranium pyrenaicum L. English type. Native. Area 9 8 . 6 5 4 3 2. Range 0-100. Road-sides and hedge-banks in several places in the low country. West Layton, Aske, Newton and Ayton in Cleveland, Thirsk, Acomb, Helmsley, Coneysthorp, Ganthorp, etc. I have no hesitation in considering the species as Native. I have not seen it within our limits as a garden plant, and it grows upon hedge-banks like *G. pusillum*, *G. molle* and *G. columbinum*.

Geranium pusillum L. English type. Native. Area general. Range 0-250. Frequent upon hedge-banks and along road-sides, ascending to Leyburn Shawl and Applegarth Scars.

Geranium molle L. British type. Native. Area general. Range 0-500. Common in similar situations to the preceding, and often growing in cultivated fields. It ascends to Keld and Tanhill. Professor Babington's record of *G. rotundifolium* from

Robin Hood's Bay (Nat., Sept. 1888, p. 265) must surely be a mistake.

Geranium dissectum L. British type. Native. Area general. Range 0-300. Common in similar situations to the preceding throughout the lower zone.

Geranium columbinum L. English type. Native. Area 8 7 6 . 3 2 1. Range 0-300. Frequent upon grassy banks in the low country, ascending to Aysgarth Force, Scarth Nick, and Applegarth Scars.

Geranium lucidum L. British type. Native. Area 9 8 7 . 3 2. Range 100-500. Frequent amongst rocks and stones in the western dales, ascending to White Force Scars. Not known to me as a plant of the Central Valley, and on the east I am acquainted with it only in a few stations amongst the calcareous hills; Boltby Scar, Whitston Cliff, Rainton heights, etc.

Geranium Robertianum L. British type. Native. Area general. Range 0-650. Common in shaded places, ascending to the Main Limestone scars of Booze Moor and Widdale Fell, and 1,900 feet at the head of Gayle Beck; *J. Percival.*

Geranium sanguineum L. British type. Native. Xerophilous. Area 5 . 3 2. Range 0-250. Amongst the eastern calcareous hills and in the Howardian tract in several places; Sutton Bank, Hawnby Bank, Yowlasdale, Flazendale, Hildenley, etc. Amongst the coast sand-hills between Redcar and Marske.

Impatiens Noli-me-tangere L. Alien. An occasional straggler from garden cultivation. Waste ground near Great Ayton; *W. Mudd*!

Oxalis Acetosella L. British type. Native. Area general. Range 0-800. Common in shaded places, ascending to the Main Limestone of Cam Fell, Widdale Fell and Mickle Fell.

Oxalis corniculata L. Alien. An occasional weed in gardens, as at Acomb and Holgate near York.

Euonymus europæus L. English type. Native. Area 9 8 7 6 5 4 3. Range 0-250. In several of the aboriginal woods of the dales, and where it does occur, unlike many of the other

shrubs, usually a true native. On the west in Balderdale, at Red Scar, Whitcliffe Wood, Clink Bank, Gilling Woods, Aysgarth Force, Leyburn Shawl. In the low country in hedges between York and Tadcaster, and by the Leven between Crathorn and Hutton Rudby. Thorpe Arch; *J. Emmet.* On the east at Newton Wood, Saltburn, Arncliffe Woods and New Holme Beck near Whitby, Beckdale, Wath Wood, Kitscrew Wood, Ashdale near Helmsley, abundant, old hedge-bank between Balk and Sutton, Kilton Castle and hedges at Brotton, etc.

Staphylea pinnata L. Alien. Subspontaneous or planted in hedges at Newton in Cleveland; *W. Mudd*! A native of Germany and the West of France.

Rhamnus catharticus L. English type. Native. Area 8 7 6 5 . 3 2 1. Range 0-250. Not unfrequent in woods and hedge-rows in the low country, ascending to the aboriginal woods of Yowlasdale, and in Wensleydale to Aysgarth Force.

Rhamnus Frangula L. English type. Native. Area 8 7 6 . 3 . 1. Range 0-200. Indigenous in some of the carrs of the Central Vale and Howardian tract. Askham Bogs, Leckby Carr, Pilmoor, Cawklees Wood, Airyholme Wood, Cum Hag Wood, Hildenley Wood, Strensall Common, etc. Hawbank Wood, Carperby; *J. Percival.*

Spartium scoparium L. British type. Native. Area general. Range 0-300. Common in sandy and heathery tracts throughout the lower zone, but comparatively rare in the calcareous dales. Cultivated up to 350 yards. In Scotland it ascends into the Arctic Region.

Ulex europæus L. British type. Native. Area general. Range 0-600. Common upon heaths and uncultivated pieces of ground both in the low country and amongst the hills. Like the preceding it is comparatively rare in the calcareous dales of the west. In Teesdale its usual place is filled by Juniper and *Potentilla fruticosa*, in Swaledale by Yew bushes. Ascends Gayledale to 1,800 feet; *J. Percival.*

Ulex Gallii Planch. English type. Native. Area 9 8 7.5. Range 0-200. In similar situations to the preceding, but rare. In the west on Barningham Moor; *T. Simpson*! Gatherley Moor; *James Ward;* and Nomans Moor near Newton-le-Willows; *W. Mudd.* In Cleveland on Black Moor, between Stokesley and Nunthorpe.

Genista tinctoria L. English type. Native. Area general. Range 0-200. Frequent in grassy places in the low country, ascending in Teesdale to Cotherstone.

Genista anglica L. British type. Native. Area 8.6 5 4 3 2 1. Range 0-300. Frequent upon heaths throughout the lower zone.

Ononis arvensis L. British type. Native. Area general. Range 0-250. Frequent in grassy places in the low country, ascending to Mickleton and Preston-under-Scar.

Ononis antiquorum Angl. British type. Native. Area 9 8.5 4 3 2 1. Range 0-150. In similar situations to the preceding, but less frequent.

Anthyllis Vulneraria L. British type. Native. Sub-xerophilous. Area general. Range 0-600. Dry banks, one of the most frequent of the species which have upon their distribution the Xerophilous stamp. On the west it is frequent about the Magnesian Limestone and in the calcareous dales, and ascends to the Sugar Limestone of the Cronkley plateau. Amongst the sand-hills and along the cliffs of the coast-line it is frequent from Middlesbrough to Scarborough. It is common in the eastern calcareous tract, and occurs in dry sandy ground in several places in the Central Vale and elsewhere; Crakehall, Romanby, Kirklington, Thirsk, Hutton Conyers, Aisenby, Acomb and Clifton Ings near York, etc.

Medicago sativa L. Alien. Frequently subspontaneous in cultivated fields. The report of *M. falcata* from Hovingham (*Flora*) is erroneous.

Medicago lupulina L. British type. Native. Area general. Range 0-300. Common upon dry banks and in

cultivated fields throughout the lower zone, ascending to the Hambleton plateau and the flagstone quarries of Leyburn Moor.

Medicago maculata Sibth. English type. Native. Area 5 4 3. Range 0-100. Sandy ground; rare. In Cleveland upon the basaltic ridge at Langbargh, and plentiful at Marske in sandy ground at the end of the village nearest the sea. Abundant also upon the Castle Hill at Scarborough, and on the south side of the Esk below Larpool Woods.

Medicago denticulata Willd. English type. Native. Area 3. Range Coast-Level. With the preceding upon the slope of the Castle Hill at Scarborough. This is the most northern indigenous station for the plant which is known in Britain. It has also been gathered by W. Foggitt upon a rubbish-heap by the side of the foot-path between Thirsk and Sandhutton. Sandy crevices of rocks below Aysgarth lowest fall, alien; *J. Percival.*

Melilotus officinalis Willd. English type. Colonist. Area general. Range 0-200. Frequent in cultivated fields in the low country, ascending in Wensleydale to Wensley and Carperby.

Melilotus arvensis Willd. Alien. This species I have only once seen within our limits, and that was in 1861, upon the edge of a cultivated field east of South Kilvington near Thirsk, where it grew in tolerable plenty.

Melilotus vulgaris Willd. Alien. Casually subspontaneous in cultivated fields and waste ground. Richmond, Kilvington, Thirsk, York, Strensall, etc.

Trifolium repens L. British type. Native. Area general. Range 0-800. Everywhere common in grassy places, ascending to the Main Limestone of Cam Fell and Mickle Fell.

Trifolium elegans Savi! Alien. This species, a native of the South of Europe, I have met with in a subspontaneous state upon the embankment of the railway near Thirsk. *T. hybridum* L., which I cannot distinguish specifically, is

occasionally cultivated in fields under the name of Allsike Clover. *T. incarnatum* L. is also sometimes cultivated and is occasionally to be met with as a weed in cultivated fields.

Trifolium pratense L. British type. Native. Area general. Range 0-550. Commonly cultivated and common as a wild plant in grassy places, ascending in Swaledale to Crook Seat, Hollow Mill Cross and the limestone plateau of Kisdon.

Trifolium medium L. British type. Native. Area general. Range 0-450. Frequent in grassy places and the borders of woods and fields, ascending to Maize Beck, Ravenseat and the falls of the Cover at the foot of Great Whernside.

Trifolium arvense L. British type. Native. Area 8 7 6 5 4 3 2. Range 0-100. Not unfrequent in sandy ground in the low country. Brompton-on-Swale, Hutton Conyers, Pickhill, Acomb, Steeton, Middlesbrough, Thirsk, Tollerton, Terrington, Malton, Robin Hood's Bay, etc.

Trifolium scabrum L. English type. Native. Area 8 7 6 5 . 3. Range 0-150. Rare in dry ground. In a limekiln at Coalsgarth and on Ellershaw Hill, near Wensley; *James Ward.* Near Acomb in the lane towards Askham and in sandy ground near the Ouse; *J. Backhouse.* In Cleveland near Nunthorpe; *W. Mudd*! At Scarborough on walls near the Castle; *R. Peirson*!

Trifolium striatum L. English type. Native. Area 8 7 . 5 . 3 . 1. Range 0-300. Rare in sandy ground, but ranging throughout the lower zone. It ascends to the flagstone quarries of Leyburn Moor, and grows upon the slope of the Richmond Castle Hill. In the Central Valley it occurs at Bury Hills near Kirklington, by the road-side between Aisenby and Leckby, in Cleveland on the basaltic ridge at Langbargh, in the Howardian tract in sand-pits at Ganthorpe and at Scarborough upon the Castle Hill. Strensall; *A. R. Waller.*

Trifolium fragiferum L. English type. Native. Area 6 5. Range 0-100. Amongst the coast sand-hills plentiful at

Middlesbrough and Coatham, and inland in damp sandy ground at Knavesmire near York.

Trifolium agrarium L. Alien. Abundant in a forage field at Moorsholm, 1881. It has also been found by T. J. and W. Foggitt in several places near Thirsk.

Trifolium filiforme L. English type. Native. Area 2 1. Range 0-100. Ouse banks, Clifton Ings; *H. Ibbotson.* Strensall; *A. R. Waller.* Holmes, Thirsk; *W. Foggitt.*

Trifolium procumbens L. British type. Native. Area general. Range 0-300. Frequent in dry ground throughout the lower zone, ascending to the flagstone quarries of Leyburn Moor.

Trifolium minus Relhan. English type. Native. Area general. Range 0-300. Frequent in grassy places throughout the lower zone, ascending on the east to Lilla Howe Cross near Sleights, and on the west as high both in Gretadale and Arkengarthdale.

Lotus corniculatus L. British type. Native. Area general. Range 0-800. Common in grassy places, ascending to the Main Limestone of Mickle Fell. *L. tenuis* is frequent in dry ground in the low country.

Lotus major Scop. British type. Native. Area general. Range 0-400. Frequent in damp and shaded places, ascending in Coverdale to the foot of Great Whernside.

Astragalus glycyphyllos L. Germanic type. Native. Xerophilous. Area 9 . 7 6 . 3. Range 0-150. In the west upon the Main Limestone near the Tees at Egglestone Abbey, and in the Yore district between East Witton and the bridge over the Cover. About the Magnesian Limestone near the Yore at Tanfield and the Wharfe at Thorpe Arch. Upon the Middle Oolite in the Howardian tract at Cawklees Wood, and near Scarborough at Barrowcliff and the White Nab.

Astragalus Hypoglottis L. Germanic type. Native. Xerophilous. Area 6 5 4 3. Range 0-150. Like the preceding this species furnishes a well-marked illustration of the Xero-

philous role of distribution. About the Magnesian Limestone near the Wharfe at Thorpe Arch. Upon the Middle Oolite in the Howardian tract and along the calcareous range by way of Pickering and Ebberston to Hackness. Amongst the coast sand-hills at Middlesbrough, Coatham and Marske.

Ornithopus perpusillus L. British type. Native. Area 8 7 6 . 3 . 1. Range 0-150. Not unfrequent in the sandier parts of the Central Vale and Howardian tract. Leeming Lane, Hutton Moor, Acomb, and many places amongst the sandy commons about Stockton, Strensall, Dunnington and Terrington.

Hippocrepis comosa L. English type. Native. Xerophilous. Area 9 . 7. Range 200-600. In Teesdale with *Helianthemum canum* upon the sugar limestone of Cronkley Fell. In Wensleydale in several places in the lower part of the dale, ascending to Carperby and Aysgarth Force; *J. Percival.*

Onobrychis sativa Lam. English type. Native? Xerophilous. Area 7 . 3. Range 0-100. About the Magnesian Limestone at Tanfield (*T. Simpson*) and Nosterfield; *M. Hebblethwaite.* Upon the Middle Oolite at Ayton near Hackness; *W. Bean.* Reported also from the neighbourhood of Thorpe Arch, and occasionally cultivated.

Vicia sylvatica L. British type. Native. Area 9 8 7 . 4 3 2. Range 0-250. Not unfrequent amongst the woods of the more undulated tracts. In Teesdale about the lower part of Deepdale and of the Greta, and about Rokeby and Egglestone Abbey. In Swaledale below the Red Scar and along Billy Bank to Richmond. In the Yore district on the slope of Leyburn Shawl, and in the woods at West Witton and Burton Constable; also in Mill Gill, Whitfield Gill, West Bolton Gill, and at Thoralby (*J. Percival*) and in Bolton Gill; *W. Robinson.* In the Central Valley on Hutton Moor, and in the Vale of Mowbray in Cotcliffe Wood. In Cleveland at Saltburn, Mulgrave Woods, Rathwaite Woods, and above the Robin Hood's Bay alum works, below Kilton Castle. In the Howardian tract in

several places and amongst the eastern calcareous hills about Hackness and Scarborough.

Vicia Cracca L. British type. Native. Area general. Range 0-400. Frequent in hedges and grassy places, ascending to Upper Cronkley and Ravenseat.

Vicia varia Host. Alien. Casually subspontaneous in tolerable plenty in a field between Thirsk and Kirkby Knowle, 1861, where it was first noted by W. Foggitt.

Vicia sativa L. British type. Native. Area general. Range 0-350. The true *V. sativa* is cultivated for forage from the vales upwards as high as field-cultivation reaches, and is frequently subspontaneous in cultivated ground. *V. segetalis* Thuill. is a common corn-field weed. *V. angustifolia* Roth is frequent in fields and grassy places throughout the lower zone.

Vicia lathyroides L. British type. Native. Area 6. Range 50. In the Ainsty in sandy ground at Acomb and in the lane towards Askham; also in sandy moory lanes at Poppleton (*H. Ibbotson*) and Moor Monckton; *F. A. Lees.* Reported also from Hutton Moor near Stokesley.

Vicia sepium L. British type. Native. Area general. Range 0-500. Common in shaded and grassy places, ascending to Cronkley Scars and the Main Limestone cliffs of West Stonesdale Moor and Punchard's Gill.

Vicia bithynica L. English type. Native. Area 4 3. Range Coast-Level. This species has long been known in one locality, the diluvial sea-bank on the north of the village of Upgang, where it still grows. The bank is mainly composed of clay, and its summit is fully 100 feet above the sea-shore, and the *Vicia* grows principally in a sandy hollow adjacent to *Hippophaë rhamnoides.* It has lately been found at Hayburn Wyke by George Massee.

Vicia hirsuta Koch. British type. Colonist. Area general. Range 0-200. Frequent in cultivated fields in the low country.

Vicia tetrasperma Koch. English type. Colonist. Area 9 8. 5 4 3 2 1. Range 0-100. In similar situations to the preceding but less frequent. Dalton-on-Tees, Richmond, Kirklington, Middlesbrough, Coatham, Eston, Northallerton, Thirsk, York, Castle Howard, Strensall, etc.

Vicia Faba,

Pisum arvense, and

Pisum sativum, are all three frequently grown both in fields and gardens, the two former up to 350 yards, the latter up to 300 yards.

Lathyrus Aphaca L. Incognit. Reported by R. Teesdale from fields at Malton.

Lathyrus pratensis L. British type. Native. Area general. Range 0-400. Frequent in grassy places, ascending to Upper Cronkley, Sleightholme, the falls above Cotterdale village, and the Main Limestone scars of West Stonesdale Moor.

Lathyrus sylvestris L. English type. Native. Area 4 3. Range 0-100. By the Esk side near Ruswarp; *W. Mudd*! and near Scarborough at Barrowcliff.

Lathyrus latifolius L. Alien. An occasional straggler from garden cultivation. A native of France and Germany.

Orobus tuberosus L. = *Lathyrus macrorhizus* Wimm. British type. Native. Area general. Range 0-500. Common in grassy and heathery places, ascending to Whitsundale and Cronkley Scars.

Prunus spinosa L. British type. Native. Area general. Range 0-450. The true *P. spinosa* is common in woods and hedges throughout the lower zone. In the aboriginal woods of the dales it is much less frequent than the Hazel and Whitethorn, and only seldom, as below Whitston Cliff, forms woods or thickets of any considerable size by itself. It ascends in Swaledale to the Main Limestone scars of West Stonesdale Moor and in Yoredale to those of Preston Scar and Harlen Fell. *P. insititia* is less frequent; and *P. domestica* is occasionally to be met

with in hedge-rows and planted woods, and is grown in gardens up to 250 yards.

Prunus Padus L. Scottish type. Native. Area 9 8 7 . 5 4 3 2. Range 0-550. Frequent in woods and hedge-rows amongst the hills, and occasionally in the open low country. It ascends to Cronkley Scars, and the Main Limestone scars of Punchard's Gill.

Prunus avium L. English type. Denizen. Area 9 8 7 . 5 4 3 2 1. Range 0-250. Frequent in woods and hedge-rows in the lower zone. Perhaps a native of some of the dale woods, as for instance those of Sleightholmedale and Arncliffe in Eskdale, but I have not seen any completely satisfactory indigenous station. It is cultivated up to 350 yards.

Prunus Cerasus L. English type. Denizen. Area 6. Range 0-100. Thorpe Arch, a single tree; *F. A. Lees.*

Spiræa Ulmaria L. British type. Native. Area general. Range 0-600. Common in damp and shaded places, ascending to the White Force Scars, the Main Limestone scars of Punchard's Gill, and the limestone pavement of Cam Fell.

Spiræa Filipendula L. English type. Native. Xerophilous. Area 8 7 6 5 4 3 2 1. Range 0-350. About the Magnesian Limestone at Catterick Bridge, Tanfield, Thornborough and Thorpe Arch. In the Central Valley at Leeming, and by the railway side south of Cowton Station; also in very small quantity at Hazel Bush, near Towthorpe Common; *A. R. Waller.* In Cleveland on the basaltic dike at Langbargh, and amongst the coast sand-hills between Marske and Saltburn. In the Howardian tract in several places, and along the calcareous range from Boltby Scar and Yowlasdale eastward to Scarborough cliffs.

Spiræa salicifolia L. Alien. Subspontaneous or planted in Aske Woods near Richmond, and Ormesby Woods near Middlesbrough. Found lately by G. Massee with *Cornus* and *Linnæa* at Cross Cliff, looking as if truly indigenous. A native

of Austria and Russia. The American *S. opulifolia* occurs, or has occurred, under similar circumstances in a wood at Easby near Richmond; *James Ward*!

Dryas octopetala L. Highland type. Native. Montane. Subxerophilous. Area 9. Range 600. With *Helianthemum canum* upon the Sugar Limestone of Cronkley Fell.

Geum urbanum L. British type. Native. Area general. Range 0-350. Frequent in woods and upon hedge-banks throughout the lower zone, ascending to the foot of Widdale and the Swale side west of Keld.

Geum rivale L. British type. Native. Area general. Range 0-800. Frequent in damp and shaded places, ascending to the Main Limestone of Mickle Fell. *G. intermedium* Ehrh., which is frequent in woods, appears to be a hybrid between this and the preceding.

Agrimonia Eupatoria L. British type. Native. Area general. Range 0-400. Frequent in grassy places, ascending in Swaledale to the Main Limestone Scars of West Stonesdale Moor.

Agrimonia odorata Mill. On the slope of Penhill above West Burton, and in Bishopdale west of Thoralby; *J. Percival.* Hedge-bank near Codbeck between Sowerby and Dalton.

Potentilla fruticosa L. Intermediate type. Native. Montane. Area 9. Range 250-400. This species in Upper Teesdale is one of the most prominent plants of the river-side. It begins at Upper Cronkley, is plentiful about the High Force and Winch Bridge, and continues down the river as far as the Middleton Bridge. It is given by Ray as a plant of the Tees side near Egglestone Abbey, but I have not seen it there, and probably it was only casually washed down. Its abundance in Teesdale, considered in connection with its rarity in the rest of Britain, is one of the most salient facts of plant-topography which it falls within the scope of these notes to register.

Potentilla anserina L. British type. Native. Area general. Range 0-350. Frequent along road-sides and in

waste ground, ascending to Marske Moor and the plateau of the Hambleton Hills above Boltby.

Potentilla argentea L. English type. Native. Area 2. Range 0-100. In sandy ground in a wood at Breckenbrough near Thirsk, gathered by one of the children of Capt. Hincks; *W. Foggitt.*

Potentilla verna L. Intermediate type. Native. Xerophilous. Area 7 . 3. Range 100-250. Reported by Curtis and Fothergill from Semmerdale, and by R. Teesdale from the neighbourhood of Hovingham, but not seen recently. Abundant on limestone cliffs in Yowlasdale; *W. Foggitt.*

Potentilla alpestris Hall. Highland type. Native. Montane. Area 9 . 7. Range 300-500. In Teesdale on Cronkley Scars and by the stream at the falls of Maize Beck and Winch Bridge. In the Yore district on the Main Limestone scars of Harlen Fell over Waldendale.

Potentilla reptans L. English type. Native. Area general. Range 0-350. Frequent in waste and grassy places, ascending to the plateau of the Hambleton Range over Boltby. Ascends Wensleydale to Bainbridge; *J. Percival.*

Potentilla Tormentilla Schk. British type. Native. Area general. Range 0-850. Common in grassy and heathery places, ascending to the peaks of almost all the higher hills, Mickle Fell, Great Whernside, Lovely Seat, etc. *P. procumbens* Sibth. is frequent in the low country.

Potentilla Fragariastrum Ehrh. British type. Native. Area general. Range 0-400. Common upon hedge-banks throughout the lower zone, ascending to the plateau of Hambleton End.

Comarum palustre L. British type. Native. Area general. Range 0-500. Frequent in peat bogs amongst the hills, ascending to the tarn on the Lunedale side of Mickle Fell. Occasionally in the open low country, as at Pickhill, Carthorpe, Askham Bogs, Carlton Carr, Leckby Carr, etc.

Fragaria vesca L. British type. Native. Area general. Range 0-500. Common in shaded and grassy places, ascending to Cronkley Scars and the Main Limestone Scars of Punchard's Gill.

Fragaria elatior Ehrh. Alien. Cultivated and occasionally subspontaneous. Richmond, Sinderby, Hobmoor near York, etc.

Rubus Chamæmorus L. Highland type. Native. Montane. Area 9 8 7. Range 400-850. Confined to the western hills. It is frequent upon most of the higher summits: Mickle Fell, Great Whernside, Dod Fell, Rogan's Seat, Nine Standards Rigg, etc., and descends to Barningham Moor and the Tees side at Upper Cronkley. This species, *Empetrum nigrum* and *Lycopodium Selago*, are the only three of the Montane plants which enter into prominent association with the swamp-heather-land florula of the high gritstone swells.

Rubus saxatilis L. Scottish type. Native. Montane. Sub-xerophilous. Area 9 8 7 . 3. Range 100-550. In Teesdale upon the scars of Cronkley Fell and Crossthwaite Beck, and about the stream at the Maize Beck Falls, Winch Bridge, Middleton and Egglestone Abbey. In Swaledale on Whitsundale Scars, in Cliff Gill, Gunnerside Gill, at Kisdon Force, and in several places lower down about Downholme and Richmond. In the Yore district at Fossdale Woods, Widdale, Gayle Force, Whitfield Force, Aysgarth Force, etc. In the dales of the eastern calcareous range frequent from the Hambleton Hills eastward to Forge Valley, and occurring also in several places in the Howardian tract.

Rubus Idæus L. British type. Native. Area general. Range 0-600. Frequent in woods and thickets, especially amongst the hills, ascending to Cronkley Scars and in Punchard's Gill above the Main Limestone cliffs and waterfall.

Rubus suberectus Anders. English type. Native. Area 8 . 6 5. Range 0-200. I have never myself been able to find this in the North Riding, although I have gathered it in Teesdale

near the High Force on the Durham side of the river. A plant gathered by James Ward near Richmond is accepted by Prof. Babington as typical *suberectus*, and the late W. Mudd found *R. fissus* Lindl. in Kildale.

Rubus plicatus W. & N. English type. Native. Area 8 6 5 . 3 2 1. Range 0-150. Found by James Ward in several places near Richmond. In the central valley in Askham Bogs, hedges near Alne, and plentiful in Carlton Carr, and near Sowerby and Woodend. In the Vale of Mowbray in Cotcliffe Wood. In the Howardian tract in Potichar Bank Wood near Hovingham. In several of the eastern dales, e.g. Kildale, Gribdale, Snailesworth, and Newtondale.

Rubus Lindleianus Lees. English type. Native. Area general. Range 0-800. Frequent in woods and hedges throughout the lower zone.

Rubus rhamnifolius W. & N. English type. Native. Area 8 7 6 5 4 3 2 1. Range 0-300. *R. affinis* Bab., non W. & N., is common through the lower zone and has been traced by J. Percival up to 1000 feet on Penhill. A curious type allied to *R. rhamnifolius* (*R. Bakeri* F. A. Lees, in 'Report of Botanical Record Club,' 1884-6, p. 120), is plentiful on the slope of the Hambleton Hills about Gormire.

Rubus pubescens W. & N.=*R. thyrsoideus* Bab. non W. & N. English type. Area 5 . 3 2. Range 0-200. Plants gathered by W. Mudd between Redcar and Kirkleatham and by myself at Laskill in Bilsdale and in hedges at Sowerby, should probably be placed here. An allied type that grows on Wass Bank is referred by Babington to *R. Colemanni* Blox.

Rubus ulmifolius Schott=*R. discolor* Bab., non W. & N. English type. Native. Area general. Range 0-300. The common Bramble of the low country hedges; seen in every district.

Rubus leucostachys Smith. English type. Native. Area 9 8 7 6 5 4 3 2. Range 0-200. Frequent in woods and thickets throughout the Riding.

Rubus villicaulis W. & N. English type. Native. Area 7 6. Range 0-200. In Wensleydale in Hawbank Wood near Carperby; *J. Percival.* Margin of Askham Bogs; *G. Webster.*

Rubus umbrosus Bab. non W. & N. = *R. polyanthemos* Lind. English type. Native. Area general. Range 0-300. Frequent in woods and thickets throughout the lower zone.

Rubus macrophyllus W. & N. English type. Native. Area 2. Range 150-200. The type is unknown in North Yorkshire, and the only certain station I can cite is for *R. amplificatus* Lees, which grows in a hedge by the road-side east of Boltby.

Rubus mucronatus Blox. Local type. Native. Area 5 4 3 2. Range 0-300. In the Central Valley in hedges at Sowerby and Thorpfield. In the Howardian tract in Gilling Woods. Amongst the eastern moorlands in several places: Newton Wood, Kildale, Lounsdale, Langbargh Wood, Wainstones Wood, Easterside, Hawnby, Boltby Bank, etc.

Rubus calvatus Blox. English type. Native. Area 6 . 3 2. Range 0-150. Chandler's Whin near Askham Bogs, and Quakers' Whin, Dringhouses; *G. Webster.* Amongst the eastern hills in the woods above Kirkby Knowle, and in thickets near Levisham Station.

Rubus Sprengelii W. & N. English type. Native. Area 8 . 5 . 3. Range 0-150. In Swaledale at the Sandbeck, and in a wood near Hipswell Lodge; *J. Ward*! In the Howardian tract in Gilling Woods. In Cleveland in Lounsdale and Airyholme Wood; *W. Mudd*!

Rubus Bloxami Lees. English type. Native. Area 6 . 3. Range 0-150. Acomb Wood; *G. Webster.* In Bilsdale in thickets near Laskill Bridge.

Rubus Radula W. & N. English type. Native. Area general. Range 0-300. Typical *Radula* is frequent throughout the Riding. I have never seen *R. Hystrix* W. & N., or *R. echinatus* Lindl. The plant called *R. Guntheri* in the first

edition is not *R. flexuosus* Lef. & Müll. (*R. Guntheri* Bab. non W. & N.), but *R. Purchasii* Blox., or a closely allied form. It grows in Deepdale and on the slope of the eastern hills in several localities.

Rubus rosaceus W. & N. English type. Native. Area 6 . 3 2. Range 0-150. In the Central Valley in hedges at Askham Richard, and plentiful in a wood midway between Sowerby and Dalton. In Bilsdale in hedges near Laskill Bridge.

Rubus pallidus W. & N. English type. Native. Area 2. Range 200. A plant which is plentiful in the woods near the top of the escarpment over Ingleby Arncliffe is referred here by Dr. Focke. The plant called *R. Lejeunei*, in the first edition, gathered at the Kildale fish-ponds by W. Mudd, is nearly allied to it, but I have not now any specimen of it to compare.

Rubus fuscoater W. & N., Bab. Synops., 212. English type. Native. Area 3. Range 150-200. Thickets in Bilsdale near Laskill Bridge.

Rubus infestus W. & N. English type. Native. Area 2. Range 150-200. With *R. amplificatus* in hedges by the roadside just out of Boltby going towards Hawnby.

Rubus Koehleri W. & N. including *R. pallidus* Bab. non W. & N. English type. Native. Area general. Range 0-300. The common Bramble of woods, both in the low country and amongst the hills, and occurring sometimes also in hedges. It ascends nearly to the head of Flazendale, and in Wensleydale to Apperset Bridge. Two forms which grow in the woods near Byland Abbey are placed by Prof. Babington under *R. humifusus* (See 'British Rubi,' p. 241).

Rubus glandulosus Smith. English type. Native. Area 8 . 3. Range 0-200. *R. Bellardi* W. & N. was figured by Borrer in 'English Botany Supplement,' tab. 2883, from Terrington Carr. I could never find it elsewhere in North Yorkshire; but *R. hirtus* W. & N. occurs in thickets near Hudswell, in Bilsdale in several places from Chop Yate down to Hawnby, and in the Howardian tract in Hovingham and Gilling Woods.

Rubus horridus Schultz=*R. dumetorum* Warren, W. & N., ex parte. English type. Native. Area general. Range 0-300. Of this there are two types in the North Riding, both common and not running into one another, viz:—1. *R. diversifolius* Lindl., noted in every drainage district, ascending in Swaledale to the Marrick Smelting Mill, and lately traced by Percival to 1000 feet in Fossdale. 2. *R. tenuiarmatus* Lees (var. *concinnus* Warren & Baker), the plant given in the first edition as *R. tuberculatus* Bab., also noted in every drainage district.

Rubus corylifolius Smith. English type. Native. Area general. Range 0-200. Next to *R. ulmifolius*, the commonest Bramble of the low country hedges, but rare amongst the hills. Ascends Wensleydale to Askrigg; *J. Percival*. *R. altheifolius*, edition 1, is a form midway between *corylifolius* and *cæsius*, found in Whitcliffe Wood near Richmond, and in hedges at Thirsk and Topcliffe. *R. Balfourianus* Blox. has been found by Webster at Acomb, and forms connecting it with *corylifolius* (referred by Genevier to his *R. degener*) in hedges at Thirsk and other places.

Rubus cæsius L. English type. Native. Area general. Range 0-300. Frequent in woods and hedges throughout the lower zone. *R. pseudo-idæus* W. & N., a hybrid between *R. idæus* and *R. cæsius*, I have seen in garden-hedges at Sowerby.

Rosa spinosissima L. British type. Native. Subxerophilous. Area 9 8 7 6 5 4 3 2. Range 0-500. In numerous stations amongst both the eastern and western calcareous hills, ascending to Cronkley and Whitsundale Scars. About the Magnesian Limestone at Catterick Bridge, Nosterfield, Tanfield and Thorp Arch. In the Central Valley at Croft, Middleton Tyas, Burrell, Brompton-on-Swale, Wath, Nunwick, Thirsk, etc. In Cleveland at Saltburn, Kirkleatham, Wilton, Guisbrough, Stokesley, Arncliffe Wood in Eskdale, Ruswarp, etc., and on

the basaltic ridge at Langbargh. In the Howardian tract in several localities.

Rosa hibernica Smith. Intermediate type. Native. Area 5 4. Range 0-200. In Cleveland sparingly in Airyholme Wood, and more abundant in hedges at Newton, where it was discovered by W. Mudd in 1853, and where I gathered it under his guidance in 1861. Hedge between Staithes and Hinderwell, 1881.

Rosa Sabini Woods. English type. Native. Area 9 8 7 6 5 4 3 2. Range 0-300. Not unfrequent in hedges and thickets throughout the lower zone. In Teesdale at Winch Bridge and Lonton, and in Swaledale at Coalsgarth. In Yoredale in Shaw Gill, Hardraw; *F. A. Lees.* About the Magnesian Limestone at Oglethorp Ings, Thorp Arch. In the Central Valley by the Tees side between Croft and Stapleton, and hedges between Thirsk and Woodend, and thickets upon the Hill-top Farm near Thornton-le-street. In Cleveland in Cliff-rig Wood, and hedges at Saltburn and Upleatham. Amongst the eastern calcareous hills in Yowlasdale and Hildenley Wood. Riccall Valley near Helmsley, and woods at Castle Howard, and Amotherby near Malton; *W. Foggitt.* This includes both *gracilis* and *Doniana.* The Teesdale plant has been referred to *R. involuta*, which probably is not specifically distinct. Var. *Robertsoni* in hedges north of Thirsk and behind Sowerby.

Rosa mollis Smith. British type. Native. Area general. Range 0-500. Frequent in hedges and thickets, finest in the dales, ascending to Cronkley and Holwick Scars.

Rosa tomentosa Smith. British type. Native. Area general. Range 0-500. Common in hedges and thickets, ascending in Teesdale to the White Force Scars, and in Arkengarthdale to the Main Limestone scars of Punchard's Gill. A wide range of forms is comprised here, including *R. intricata* Crepin!, *R. cuspidata* Boreau, and a plant with ciliated petals which in other respects corresponds with normal *R. tomentosa.*

Rosa micrantha Smith. English type. Native. Area 8 7 6 . 4. Range 0-250. In Upper Swaledale in several places about Satron and Gunnerside. In Wensleydale in Bear Park near the waterfalls; *F. A. Lees*. Hedges on the north side of the Wharfe at Thorp Arch; *S. Hailstone*! In Cleveland in Mulgrave Woods and hedges at Sandsend. Glen below Kilton Castle, 1881. *R. inodora* as a plant of North Yorkshire is quite doubtful.

Rosa rubiginosa L. English type. Native. Area 9 8 . 5 . 3 2. Range 0-150. Rare in woods and perhaps introduced in some of its stations. In Swaledale in Marske Woods. Hedges at Forcett and near the Tees west of Gainford. In the Central Valley at Sandhutton and between Yarm and High Worsall. Hedges between Pickering and Kirkby-Moorside. Cultivated in gardens up to 350 yards.

Rosa canina L. British type. Native. Area general. Range 0-450. Much the commonest Rose of the hedges and thickets of the low country, ascending in Arkengarthdale to Copperthwaite Scars. We have in North Yorkshire nearly all the forms that occur anywhere in Britain.

Rosa arvensis L. English type. Native. Area general. Range 0-150. Frequent in thickets and hedge-rows, the most plentiful in the lower part of some of the calcareous dales, as, for instance, Ryedale about Rievaulx and Helmsley. *R. systyla* is reported by R. Spruce from hedges in the Vale of Pickering near Kirkby Misperton.

Sanguisorba officinalis L. Intermediate type. Native. Area general. Range 0-500. Common in grassy places, ascending in Teesdale to the falls of Maize Beck.

Poterium Sanguisorba L. English type. Native. Sub-xerophilous. Area general. Range 0-550. One of the most widely distributed of the species which have the Xerophilous restriction. It is frequent in the limestone country both on the west and east of the Central Valley, and ascends to the Main Limestone of Gilmanscar, Copperthwaite Moor, and Askrigg

Moor. In the Central Valley it grows by the Tees side between Croft and Dalton, by the Swale at Mawnby, and by the Ouse along Clifton Ings near York; upon the Lias at Knayton; upon the basaltic dike at Langbargh; and amongst the coast sand-hills at Redcar, Marske, Sandsend, and Whitby.

Alchemilla vulgaris L. British type. Native. Area general. Range 0-800. Frequent in grassy places, ascending to the Main Limestone of Mickle Fell.

Alchemilla arvensis L. British type. Native. Area general. Range 0-450. A common weed of cultivated fields from the vales upward as high as field-cultivation reaches, and sometimes growing also upon walls and dry banks. It ascends in Teesdale to the slope of Holwick Fell.

Cratægus Oxyacantha L. British type. Native. Area general. Range 0-500. The ordinary component of the vale hedge-rows and common also in woods and thickets amongst the hills, ascending in Teesdale to Cronkley and Holwick Scars, in Swaledale to Copperthwaite Scars and the Main Limestone cliffs of Harlen Fell. *C. monogyna* Jacq. is the commonest form.

Pyrus communis L. English type. Denizen. Area 1. Range 0-100. Rare in hedges. It grows by the side of the road at Stockton near York, and in hedges by the side of the road between Thirsk and Easingwold, not far from where it crosses the Kyle. Hedge by the side of the road near Stockton Forest; *A. R. Waller*. Our plant has strong spines and glabrous mature leaves and is *P. Pyraster* Boreau. Cultivated in gardens up to 300 yards both against walls and as a standard.

Pyrus Malus L. English type. Native. Area general. Range 0-300. Common in woods and hedges in the low country and occasionally in the aboriginal dale woods as in Lunedale and Sleightholmedale. Cultivated in gardens up to 350 yards.

Pyrus Aria Smith. English type. Native. Montane. Xerophilous. Area 9 8. Range 300-500. Indigenous in

Teesdale upon Holwick Scars, and in Swaledale upon the Red Scars near Downholme. It grows in the bed of the Tees at Winch Bridge, but, I believe, only upon the Durham side of the river, and in plantations is not uncommon. Our plant is *P. rupicola* Syme, not typical *Aria*.

Pyrus torminalis L. Alien. Recorded by C. C. Babington from Robin Hood's Bay, but not at all likely to be really wild there.

Pyrus Aucuparia Gaertn. British type. Native. Area general. Range 0-600. Not common in the low country, or in hedge-rows and plantations, but one of the most frequent indigenous trees amongst the arenaceous hills, where it is often associated with the Birch. The highest stations in which I have seen it are upon the banks of a stream upon the plateau of Holwick Fell, and on the spur of Cronkley Fell west of the White Force. No other tree ascends higher with us than this, and only the Juniper as high. For North Yorkshire we may say that the presence of trees, either aboriginal or planted, marks the Agrarian Region; the presence of fruticose *Rubi*, *Viburnum Opulus*, *Cornus sanguinea*, and *Acer campestre* the Lower Zone.

Epilobium angustifolium L. British type. Native. Montane. Area 9 8 7 6 5 . 3 . 1. Range 0-600. In Teesdale upon the scars of Cronkley and Holwick, and by the stream-side at Blea Beck and the High Force, and about the lower part of the Balder and the Greta. Abundant on the open moor near the source of the Greta; *W. Foggitt*. Plentiful in the West Swale district in Whitsundale, and occurring also in Punchard's Gill and several places lower down the river as far as Richmond. In the Yore district at the head of Gammersgill and about the upper falls of Cotterdale, and in Mossdale, and ascends to 600 yards at the head of Gayledale and in the swallow holes of Ten End; *J. Percival*. By the Wharfe near Thorp Arch, and in the Central Valley on Stockton Common and in Friarage Woods near Yarm. Amongst the eastern hills in several places; Kildale, Bilsdale, Flazendale, Scarborough, Kilton Castle Woods, and in the Howardian tract.

Epilobium hirsutum L. English type. Native. Area general. Range 0-200. Common in watery places in the low country, ascending in Wensleydale to Carperby.

Epilobium parviflorum Schreb. British type. Native. Area general. Range 0-300. Common in watery places throughout the lower zone, ascending to Bowes, Marske Moor, and Langthwaite in Arkengarthdale. W. W. Reeves has lately gathered at Middleton near Pickering a plant which is referred by Dr. Haussknecht to *E. persicinum* Reich., and considered by him as a hybrid between this species and *E. roseum*.

Epilobium montanum L. British type. Native. Area general. Range 0-550. Common in damp and shaded places from the vales upwards to White Force Scars and the Main Limestone cliffs of Harlen Fell and Punchard's Gill.

Epilobium roseum Schreb. English type. Native. Area 9 8 7 6 . 2 1. Range 0-150. Watery places in the low country, rare. Richmond, Manfield, Masham, about Codbeck in several places, and about the Foss and on Stockton Forest and in other places in the neighbourhood of York.

Epilobium palustre L. British type. Native. Area general. Range 0-650. Frequent in damp places, especially amongst the hills, ascending nearly to the summit of Dod Fell. A plant which grows at Gormire (*E. ligulatum* Baker) is intermediate in many of its characters between this species and *E. obscurum*, and is probably a hybrid.

Epilobium obscurum Schreb. British type. Native. Area general. Range 0-350. Frequent in watery places, especially amongst the dales, ascending in Swaledale to Keld, and Wensleydale to Hawes and Simonstone; *J. Percival.*

Epilobium alsinifolium Vill. Highland type. Native. Montane. Area 9 8. Range 500-750. In Teesdale upon the slope of Mickle Fell both towards the Tees, Maize Beck, and the Lune; and in Swaledale near the lead-mines in Gunnerside Gill and Punchard's Gill.

Circæa lutetiana L. British type. Native. Area general. Range 0-400. Frequent in shaded places, ascending to the woods of Fossdale and Gunnerside Gill.

Œnothera biennis L. Alien. Casually subspontaneous in waste ground in the neighbourhood of gardens. Indigenous in Temperate America.

Hippuris vulgaris L. British type. Native. Area 8 7 6 5 4 3 2 1. Range 0-250. Frequent in ponds and slow streams in the low country. In the Wiske, Yore, Wharfe, Foss, Derwent, Costa, etc. Bedale, Snape, Pickhill, Guisbrough, Slingsby, Malton, etc. In the Yore district in Semmer Water, in Strands Pasture, Carperby, and in Bishopdale Beck above Thoralby; *J. Percival.*

Myriophyllum verticillatum L. English type. Native. Area 8 7 . 5 4 3 2 1. Range 0-250. Not unfrequent in similar situations to the preceding. Langton, Pickhill, Yarm, South Stockton, Sleddale, Topcliffe, Crambeck, Strensall, in the Wiske and Derwent.

Myriophyllum spicatum L. British type. Native. Area 9 8 7 . 5 4 3 2 1. Range 0-400. Frequent in ponds and streams, ascending in Teesdale to Upper Cronkley.

Myriophyllum alterniflorum DC. British type. Native. Area 7 6 . 3 2 1. Range 0-200. Peaty ponds and ditches, with us the rarest of the three species. Askham Bogs, Carlton Carr, Stockton Forest, Gormire, Newtondale, etc. Frequent in many places in the Yore and its tributaries; *J. Percival.*

Callitriche verna L. including *C. platycarpa* Kutz. British type. Native. Area general. Range 0-750. Common in ponds and slow streams, ascending to the little tarn on the end of the fell on the north of the source of the Swale, and the springs which issue from the Main Limestone of Mickle Fell.

Callitriche pedunculata DC. British type. Native. Area 9 8 7 6 5 4 3 2. Range 0-350. In similar situations to the preceding throughout the lower zone, but less frequent.

Ceratophyllum demersum L. English type. Native. Area 1. Range 50. In the Foss near York, and with *Anacharis* in the Foss Island ditches. *C. submersum* is reported by Archdeacon Peirson from ponds at Newburgh.

Lythrum Salicaria L. English type. Native. Area general. Range 0-250. Frequent in watery places in the low country, ascending in the Yore district to Semmer Water.

Peplis Portula L. British type. Native. Area 9 8 7 . 4 3 2 1. Range 0-400. Ponds upon heaths, not unfrequent. In Teesdale at Upper Cronkley and in Swaledale on Downholme Moor. In Wensleydale by the Yore about Aysgarth Falls; *J. Percival*. About Pilmoor, Stockton Forest, and Strensall Common. In the Howardian tract in several places. Amongst the eastern hills at Randaymere near Sleights and on Scawton Moor. Abundant in the hollow west of Gormire, 1886.

Bryonia dioica L. English type. Native. Area general. Range 0-100. Hedges in the low country, not by any means a common plant, but yet noted in all the nine districts.

Montia fontana L. British type. Native. Area general. Range 0-750. Frequent in streams and damp places, especially amongst the hills. It ascends to the ridge between the peak of Nine Standards Rigg and the source of the Swale, and to the springs which issue from the Main Limestone of Mickle Fell.

Claytonia perfoliata Don. Alien. Sandy field at Acomb; *F. A. Lees.*

Scleranthus annuus L. British type. Native. Area 8 . 6 . 3 2 1. Range 0-100. Not unfrequent in sandy fields in the low country.

Berberis vulgaris L. English type. Native. Area general. Range 0-200. Frequent in hedges and thickets in the low country, and occasionally amongst the hills.

Epimedium alpinum L. Alien. Subspontaneous or planted in Kildale Woods; *W. Mudd*! A native of Austria and Italy.

Ribes nigrum L. Intermediate type. Denizen. Area 9 8 7 6 5 4 3 2. Range 0-250. Commonly cultivated in gardens up to 350 yards, and frequently as if spontaneous in hedges and by the side of streams. I have not seen either this species or the following in a clearer indigenous condition.

Ribes rubrum L. Intermediate type. Denizen. Area 9 8 7 6 5 4 3 2. Range 0-350. Commonly cultivated in gardens up to 350 yards, and, like the preceding, frequent in hedges and upon the banks of streams.

Ribes petræum Smith. Scottish type. Native. Montane. Area 9 8 7. Range 100-500. About the Tees and its branches from Cronkley Scars downwards by way of Lonton, Mickleton, Cotherstone, Deepdale and Rokeby to Piercebridge. In Swaledale in several places; Stonesdale, Crackpot, Low Row, Reeth, Downholme, Hudswell and Easby. In the Yore district in Whitfield Gill; and Widdale Gill; *F. A. Lees*. Robson's *R. spicatum* grew formerly in an open wood at Applegarth near Richmond, but is now destroyed.

Ribes alpinum L. Intermediate type. Native. Area 9 8 7 . 5 . 3 2 1. Range 0-250. Clearly indigenous in some of the woods of the lower part of our western dales, especially in Swaledale and the dale of Gilling. Wild up Gayle Beck near Aisgill Force; *F. A. Lees*. Woods and hedges in several places elsewhere; Piercebridge, Thirsk, Knayton, Bagby, Ingleby Greenhow, Kildale, Thormanby, Coxwold, etc.; but probably planted in some of these stations.

Ribes Grossularia L. Intermediate type. Denizen. Area general. Range 0-300. Commonly cultivated up to 350 yards, and commonly subspontaneous in woods and hedge-rows throughout the lower zone. The station most likely to be natural in which I have seen it is in Flazendale, where from a dozen to a score bushes form a thicket at the bottom of a calcareous glen, side by side with a similar thicket of Blackthorn. Upon the turf beneath them *Ophrys muscifera* grows, and some

of the adjacent woods are clearly of aboriginal growth ; but as there does not seem to be any of the *Ribes* elsewhere amongst them it is not unlikely it may have been planted, although there are no houses in the glen and no trace of an enclosure. I have noticed it in other stations by scores, but almost always single bushes, or two or three together, either by the stream-sides or in hedge-rows.

Sedum Rhodiola DC. Incognit. Reported in the Flora from Maize Beck and Cronkley Scars, but not seen there recently. It grows with *Saxifraga nivalis* in High Cup Nick, a few miles upon the Westmorland side of Mickle Fell.

Sedum Telephium L. including *Sedum purpureum* Tausch. English type. Native. Area 9 8 . 6 . 3 2 1. Range 0-500. Rocks and sandy ground from the vales upwards to the hill cliffs, rather rare. Cronkley Scars, High Force, Clink Bank, Carthorpe, Thirsk, Sandhutton, Yearsley Moor, Stillington, Acomb, Copmanthorp, Rosedale, Welburn, Stockton, Strensall, etc.

Sedum villosum L. Highland type. Native. Montane. Area 9 . 7. Range 200-750. In Teesdale about the springs of Mickle Fell, and eastward to Kelton Fell, descending to the mouth of the Balder. In Gretadale at Sleightholme Falls. In the Yore district on Widdale Fell, Ten End, and Great Whernside, also at Semmerdale and Coverdale. Over Simonstone by the Muker Road ; *J. Percival.*

Sedum dasyphyllum L. Alien. Occasionally subspontaneous on walls and roofs. Bedale, Camphill, Tanfield, Coxwold, Terrington, Malton, Kirkby Moorside. Indigenous in France.

Sedum album L. Alien. Like the preceding occasionally subspontaneous on walls and roofs. Greta Bridge, Richmond, Bedale, Leyburn Shawl, walls at Bainbridge and near Semmerwater, Scawton near Helmsley, Lofthouse, Lythe, Easington, Terrington, Middleton.

Sedum anglicum Huds. Atlantic type. Native. Area 5.3. Range 0-100. In Cleveland at the round hill on Langbargh Rigg; *W. Mudd.* On the Castle Hill at Scarborough; *W. Bean.*

Sedum acre L. British type. Native. Area 9 8 7 6 5 4 3 2. Range 0-500. Walls and dry banks, frequent, ascending from the coast sand-hills to the Main Limestone Scars of the Buttertubs Pass.

Sedum sexangulare L. Alien. Occasionally subspontaneous on walls and roofs. Stokesley, Lofthouse, Castleton, Scarborough.

Sedum reflexum L. is frequently and

Sedum elegans Lej. occasionally subspontaneous on walls and roofs, but I have not seen either of them in stations at all likely to be natural: and

Sempervivum tectorum is common under similar circumstances.

Cotyledon Umbilicus L. Atlantic type. Native. Area 7. Range 150. Reported by Rev. J. E. Leefe as having been found by Miss Otter on walls in Wensleydale at West Witton.

Saxifraga Geum and

Saxifraga umbrosa are both occasionally subspontaneous in plantations and parks, as for instance on the bank of the Wharfe above Thorp Arch.

Saxifraga stellaris L. Highland type. Native. Montane. Area 9. Range 350-800. In Teesdale upon the slopes of Mickle Fell towards the Lune and Maize Beck, and along the Tees as far as the High Force.

Saxifraga Hirculus L. Intermediate type. Native. Montane. Area 9. Range 350-700. In Teesdale in three places on the slope of Mickle Fell towards the Caldron Snout, one of them not much below the summit-ridge. In Balderdale on the banks of the Black Beck near its junction with the Balder, and also in rills near the Balder about midway between the other station and the highest farm-house in the dale.

Saxifraga aizoides L. Highland type. Native. Montane. Area 9 . 7. Range 350-750. In Teesdale along with *S. stellaris* about Mickle Fell and Upper Cronkley. It has been seen down the river at Piercebridge, no doubt casually carried down; and is also reported from Whitfield Gill in Wensleydale.

Saxifraga granulata L. British type. Native. Area 9 8 7 . 5 4 3 2. Range 0-500. Frequent in fields and upon rocks in Teesdale and elsewhere amongst the hills, ascending to Cronkley Scars, and occasionally also in the Central Valley, as at Kirklington, Northallerton and Hutton Conyers.

Saxifraga tridactylites L. British type. Native. Area general. Range 0-650. Common upon walls and rocks, ascending to the limestone pavement of Widdale Fell, and the Main Limestone Scars of Booze Moor.

Saxifraga hypnoides L. Scottish type. Native. Montane. Area 9 8 7. Range 300-850. Confined to the western hills, where it is frequent throughout the two upper zones. It ascends to the peaks of Mickle Fell, Widdale Fell, and Cam Fell, and descends to Gunnerside and Appersett Bridge.

Chrysosplenium oppositifolium L. British type. Native. Area 9 8 7 . 5 4 3 2 1. Range 0-800. Frequent in damp places amongst the hills, ascending to the Main Limestone of Mickle Fell. In the Central Valley by the Tees side at Croft.

Chrysosplenium alternifolium L. British type. Native. Area general. Range 0-750. Frequent in similar situations to the preceding, ascending to the springs which issue from the Main Limestone of Mickle Fell.

Parnassia palustris L. Scottish type. Native. Area 9 8 7 6 5 4 3 2. Range 0-500. Frequent in damp places amongst the hills, especially in the calcareous dales, where, like *Primula farinosa* and *Blysmus compressus*, it usually grows in tufaceous swamps. In the Central Valley at Carthorpe, Thirsk, Sandhutton, Askham Bryan, and Newby Wiske; and amongst the coast banks at Lofthouse, Whitby and Scarborough.

Adoxa moschatellina L. British type. Native. Area 9 8 7 6 5 4 3 2. Range 0-300. Frequent in shaded places throughout the lower zone, ascending to the top of Whitston Cliff Woods and Mill Gill Force near Askrigg.

Hedera Helix L. British type. Native. Area general. Range 0-450. Common upon trees, banks and rocks from the valleys upwards amongst the hills, ascending to Fossdale Woods and Hell Gill, and the Main Limestone Scars of Harlen Fell and Copperthwaite Moor.

Cornus sanguinea L. English type. Native. Area general. Range 0-300. Frequent in woods and hedge-rows throughout the lower zone, ascending on the west to the Red Scar near Downholme, and on the east to Hawnby Bank.

Cornus suecica L. Highland type. Native. Montane. Area 3. Range 150-250. On the edge of the slope of the Middle Oolite near the head of the Hole of Horcum; also at Cross Cliff Banks and lower down the Derwent near Hackness. Except *Carex pauciflora* the only Montane plant noted in East Yorkshire which does not occur also amongst the hills on the west of the Central Valley.

Hydrocotyle vulgaris L. British type. Native. Area general. Range 0-300. Frequent in swamps throughout the lower zone.

Sanicula europæa L. British type. Native. Area general. Range 0-350. Frequent in woods, especially amongst the hills, ascending in Wensleydale to Shaw's Gill near Hardraw.

Eryngium maritimum L. British type. Native. Maritime. Area 5 . 3. Range Coast-Level. Upon the sea-bank near Lazenby Station; *D. Ferguson.* Cliff beyond the Spa at Scarborough (*Flora*), and said also to have been found near Cloughton.

Conium maculatum L. British type. Native. Area general. Range 0-300. Common in shaded and damp places throughout the lower zone, ascending in Swaledale to Muker, in Wensleydale to Sedbusk.

Smyrnium Olusatrum L. English type. Denizen. Area 6 5 4 3 2. Range 0-100. Plentiful upon the cliff at Whitby, and the Castle Hill at Scarborough. Inland at Northallerton, in a wood at Pinchinthorpe, in the churchyard at Wighill, and by the Tees side at Hurworth.

Cicuta virosa L. English type. Native. Area 8 . 3 2. Range 0-100. In the Central Vale in Ainderby Carr and Newsham Carr. In the Vale of Pickering near the Derwent along Old Malton Ings.

Apium graveolens L. English type. Native. Maritime. Area 5 4 3. Range Coast-Level. Plentiful about the salt-water ditches at Middlesbrough and Coatham, and about the lower part of the Esk; and occurring also at Saltburn, Runswick, and Scarborough.

Petroselinum sativum Hoffm. Alien. Commonly cultivated in gardens, ascending to 500 yards, and occasionally subspontaneous. A native of the South of Europe.

Helosciadium nodiflorum Koch. English type. Native. Area general. Range 0-250. Common in watery places in the low country, ascending in Swaledale to Summer Lodge Beck near Crackpot; and in Wensleydale to Leyburn and Thoresby Green; *J. Percival.*

Helosciadium inundatum Koch. British type. Native. Area 9 8 . 6 5 4 3 2 1. Range 0-550. Frequent in swamps and ponds both in the low country and amongst the hills, ascending to a pond upon the plateau of Cronkley Fell.

Ægopodium Podagraria L. British type. Native. Area general. Range 0-250. Frequent by stream-sides and in shaded places in the low country, ascending in Swaledale to a wood near the Marrick smelting-mill.

Carum Carui L. Alien. Casually subspontaneous in waste ground. Richmond, Sober Hill, Cargo-fleet, Scarborough, Thirsk, Melmerby, etc.

Bunium flexuosum With. British type. Native. Area general. Range 0-450. Common in grassy places from the

valleys upwards to the middle zone moorlands, ascending to Whitsundale Scars.

Pimpinella Saxifraga L. British type. Native. Area general. Range 0-500. Frequent on dry banks and in grassy places, ascending to Cronkley Scars, and the Main Limestone Scars of Booze Moor and Copperthwaite Moor.

Pimpinella magna L. English type. Native. Area 8 7 6 . 3 2 1. Range 0-150. Not unfrequent in the low country in sandy and gravelly ground. Richmond, Bedale, Crakehall, Tanfield, Thorp Arch, York, Thirsk, Easingwold, Oulston, Coxwold, Strensall, etc.

Sium latifolium L. English type. Native. Area 5 . 3 . 1 Range 0-100. Stream-sides and ditches in the vales, rare. In the Central Vale in Coatham Marshes and several places about the lower part of the Foss. About the Derwent from the mouth of the Rye past Malton to Crambeck.

Sium angustifolium L. English type. Native. Area 8 7 6 5 . 3 2 1. Range 0-200. Watery places, frequent in the vales, and occasionally beyond their limits. Ravensworth, Sedbury, Morton Carr, Flazendale, Beckdale, etc. Near Leyburn and in a brook below Thoresby Green ; *J. Percival.*

Bupleurum rotundifolium L. Germanic type. Colonist. Area 8 7 . 5 . 3 2. Not unfrequent in cultivated fields in the low country. Kiplin, Hutton, Spennithorn, Nosterfield, Snape, Dishforth, Northallerton, Crathorn, Barton, Slingsby, Malton, etc.

Œnanthe fistulosa L. English type. Native. Area 9 8 . 6 5 . 3 2 1. Range 0-100. Frequent in watery places in the low country.

Œnanthe crocata L. British type. Native. Area 7 . 5 . 3. Range 0-100. Rare in watery places in the low country. In a wood near the bridge over the Yore between Leyburn and Middleham. In the Central Vale about the Tees at Yarm. In the Vale of Pickering about the Derwent from the mouth of the Rye downward.

Œnanthe Lachenalii Gmel. English type. Native. Area 8 . 5 . 2. Range 0-100. Rare in watery places in the Central Valley. By the Tees side at Stockton, near the mill-dam at South Otterington, and in boggy ground between Cundall and Dishforth.

Œnanthe Phellandrium Lam. English type. Native. Area 9 8 7 6 . 3 2 1. Range 0-100. Frequent in watery places in the low country.

Æthusa Cynapium L. British type. Colonist. Area general. Range 0-300. Common in cultivated fields, ascending Wensleydale to Hawes ; *J. Percival.*

Silaus pratensis Bess. English type. Native. Area general. Range 0-300. Frequent in grassy places throughout the lower zone, ascending to Winch Bridge and the plateau of the Hambleton range over Hawnby.

Meum athamanticum Jacq. Scottish type. Native. Montane. Area 7. Range 300-350. In the Yore district in meadows at Mossdale Head (*J. Fothergill*) ; not seen by *F. A. Lees* or *J. Percival.*

Angelica sylvestris L. British type. Native. Area general. Range 0-550. Common in damp and shaded places both in the low country and amongst the hills, ascending to Cronkley Scars, Whitsundale Scars, and the falls of the Cover at the foot of Great Whernside.

Peucedanum Ostruthium Koch. Intermediate type. Denizen. Area 9 8 7. Range 200-400. Well established in the upper part of all the three western dales, but like *Senecio saracenicus* and *Chenopodium Bonus-Henricus*, always in proximity to barns and farm-houses. In Teesdale at Lower Cronkley, Lonton and Cotherstone. In Swaledale at Ravenseat, Keld, and at the farm-houses where Sleddale Beck joins the main stream of Swale. In the Yore district at Hawes, Busk (Semmerdale) and Thoralby. Still dried in some places, and hung up from the rafters to use as a medicine for cows, and no doubt originally

planted for this purpose. It is called by the dale farmers 'Angelica.'

Pastinaca sativa L. English type. Native. Subxerophilous. Area 8 7 6 . 1. Range 0-200. In Swaledale in the park at Marrick; *James Ward.* In Wensleydale on Shawcote Scar near Askrigg; *F. A. Lees.* In the Central Valley in small quantity near the railway at Strensall; *A. R. Waller.* In the Ainsty about the Magnesian Limestone at Thorp Arch; *J. Backhouse.*

Heracleum Sphondylium L. British type. Native. Area general. Range 0-450. Common in grassy and shaded places from the vales upwards to the hill-glens. It ascends to the Main Limestone Scars of Punchard's Gill and Harlen Fell.

Daucus Carota L. British type. Native. Area general. Range 0-300. Frequent upon dry banks throughout the lower zone, ascending to fields of the plateau of the Hambleton range over Arden, and in Wensleydale to Aysgarth and Shawcote Scars, Askrigg; *J. Percival.*

Caucalis daucoides L. Germanic type. Colonist. Area 7 6 . 3. Range 0-100. Cultivated fields, rare. Still to be found about the Magnesian Limestone at Nosterfield, Tanfield and Thorp Arch, whence it is recorded by J. Dalton and R. Teesdale. In the Howardian tract at Appleton, Barton and Hildenley.

Torilis Anthriscus Gaertn. British type. Native. Area general. Range 0-450. Frequent upon hedge-banks and shaded places, ascending in Wensleydale to Preston Scar Woods, and in Arkengarthdale to the Main Limestone Scars of Copperthwaite Moor.

Torilis infesta Spreng. English type. Colonist. Area 8 . 2. Range 0-100. Occasionally in cultivated fields. In the Central Vale at Carthorpe, Leeming, Kirkby Wiske and Woodend. In the Vale of Mowbray upon the Lias at Sutton-under-Whitstoncliff.

Torilis nodosa Gaertn. English type. Colonist. Area 9 8 . 6 5 4 3 2. Range 0-100. Not unfrequent in cultivated fields in the low country, especially in the more sandy portions of the Central Valley.

Scandix Pecten L. British type. Colonist. Area general. Range 0-350. Common in cultivated fields, ascending as high as field-cultivation reaches.

Anthriscus vulgaris Pers. British type. Native. Area 8 . 6 5 4 3 2. Range 0-150. Frequent in sandy ground in the low country, ascending in Swaledale to Fremington.

Anthriscus sylvestris Hoffm. British type. Native. Area general. Range 0-450. Common in grassy places both in the low country and amongst the hills, ascending to Ravenseat, Hell Gill, Fossdale Woods, and the Main Limestone Scars of Kisdon.

Anthriscus Cerefolium Hoffm. Alien. Casually subspontaneous in waste ground near Great Ayton; *W. Mudd*! Hedge-bank near a garden at Thirsk, 1859, and waste ground north of Norby by the side of Codbeck with *Erysimum cheiranthoides*.

Chærophyllum temulentum L. British type. Native. Area general. Range 0-400. Common upon hedge-banks and in shaded places, ascending in Swaledale to the Main Limestone Scars of West Stonesdale Moor.

Myrrhis odorata Scop. Intermediate type. Native. Montane. Area 9 8 7 . 5 4 3 2. Range 0-400. With us clearly an indigenous plant of the Montane rôle of dispersion, and one of the commonest Montane species we have. It is common in fields and by the side of the streams in the dales of both the western and eastern hills. It ascends in Teesdale to Upper Cronkley, and in the Yore district to the point of junction of the two branches of the Cotterdale stream. It is carried down by the Tees, Swale, and Yore into the Central Valley, and by the Derwent into the Vale of Pickering, but I know of it in one place only in the Central Valley apart from the streams which

rise amongst the hills, and that is in a field at Sowerby near Thirsk. By the Esk at Whitby it grows side by side with some of the characteristically Maritime species. I have seen it at Coxwold and Boltby, and it occurs in the Howardian tract in several places. With us its nearest geographical allies are *Crepis paludosa*, *Trollius europæus* and *Stellaria nemorum*. P.S.—Recent experience of how readily this spreads spontaneously makes me much less confident now that it is a Native than I was in 1863.

Viscum album L. English type. Native. Area 6. Range 50. In the Ainsty in the woods about Nun Appleton. Apple-trees on Steeton Hall Farm; *W. Whitwell*. Very fine on an apple tree in our orchard in Feliskirk Lane near Thirsk, doubtless planted; *W. Foggitt*. Formerly found upon a crab-tree at Sowerby near Thirsk.

Sambucus nigra L. British type. Native. Area general. Range 0-450. Common in woods and hedges in the low country. Frequent in the aboriginal dale woods, and clearly indigenous at 450 yards upon the Main Limestone Scars of Copperthwaite Moor near Reeth, with Ivy, Holly, and Yew.

Sambucus Ebulus L. English type. Native. Area 9 8 7 6 5 4 3 2. Range 0-300. Clearly indigenous in, at any rate, some of its stations within our limits. Thickets and stream-sides; about the Magnesian Limestone at Piercebridge and Thorp Arch, and in the Central Valley at Melsonby, Leeming, Leckby, Hutton Conyers, Hilton (near Yarm), Otterington, Sigston, etc. Small wood above Leyburn Shawl; *J. Percival*. Quarry at Birdforth and hedges adjoining, abundant; *W. Foggitt*. It grows with *Actæa spicata* and *Rubus saxatilis* in the aboriginal woods of Beckdale; and occurs also on the Castle Hill at Scarborough, in the Esk district at Ellerby, and in the Howardian tract at Bransby.

Viburnum Opulus L. British type. Native. Area general. Range 0-300. Frequent in woods and hedges throughout the lower zone. It is not unfrequent in the aboriginal dale

woods, and ascends in Teesdale to Winch Bridge, and in Wensleydale to Preston Scar.

Viburnum Lantana L. Denizen. Area 6 5. Range 0-100. Hedge-bank near Leven Bridge, apparently indigenous, 1863. Scrub at Bilton Haggs, north of Wighill Park; *F. A. Lees.* Occasionally in plantations, as at Aske, Ormesby, Mulgrave Woods, Scarborough, etc.

Lonicera Periclymenum L. British type. Native. Area general. Range 0-450. Common in woods and hedges, ascending in Teesdale to Holwick and Blea Beck Scars.

Lonicera Caprifolium L. Alien. Occasionally subspontaneous or planted in hedge-rows. Bedale, Pickhill, Thorp Arch, Newtown (Cleveland), etc. *L. Xylosteum* also occurs occasionally under similar circumstances. Aske, Thorp Arch, Woodend, Yarm, etc.; and a single bush of *L. etrusca* grows or grew in a hedge at Holgate near York.

Linnæa borealis Gronov. Scottish type. Native. Montane. Area 3. Range 250-300. Silpho Moor, between Scarborough and Whitby, discovered in 1863 by John Tissiman.

Galium verum L. British type. Native. Area general. Range 0-650. Common in grassy places, ascending to the Main Limestone Scars of Widdale Fell.

Galium cruciatum With. British type. Native. Area general. Range 0-500. Common in shaded and grassy places, ascending to the summit of Hambleton plateau over Boltby, and the moor near the Hind Rake lead-mine near Reeth.

Galium palustre L. British type. Native. Area general. Range 0-600. Common in damp places, ascending to the ridge between Nine Standards Rigg and the source of the Swale. *G. elongatum* Presl is frequent, and *G. debile* Desv. occurs occasionally in the low country.

Galium uliginosum L. British type. Native. Area 8 7 6 . 3 2. Range 0-200. Not unfrequent in damp ground in the low country, ascending Swaledale to Coalsgarth; and in Wensleydale to Locker Tarn marsh, Carperby; *F. A. Lees.*

Galium saxatile L. British type. Native. Area 9 8 7. 5 4 3 2 1. Range 0-850. Common in heathery and grassy places from the low country upwards to the peaks of most of the higher hills; Mickle Fell, Dodd Fell, Great Whernside, etc. One of the few species which are common throughout the widest vertical range which is possible within our limits. Most likely a plant of the Ainsty, but I have no note of it as such.

Galium erectum Huds. Germanic type. Native. Xerophilous. Area 3. Range 100-150. In the Howardian tract on the limestone terrace at Slingsby Heights and in a quarry outside Kitscrew Wood near Hovingham. Both of these stations were first found by Henry Ibbotson, who gathered and distributed numerous specimens. Recorded by Baines from Hob Moor, probably in error.

Galium Mollugo L. English type. Native. Area 9 8 7 6 5 4 3 2. Range 0-350. Not unfrequent in hedges throughout the lower zone, ascending Swaledale to Keld and Thwaite, and Wensleydale to Bainbridge and Hawes. Var. *Bakeri* Syme; on a dry hilly crest of Gormire. *G. insubricum* Gaud. grows upon a shaded hedge-bank between Thirsk and Sandhutton, where it was found by T. J. Foggitt.

Galium pusillum Angl. (*G. sylvestre* Poll. with *G. commutatum* Jordan). Intermediate type. Native. Montane. Subxerophilous. Area 9 8 7. Range 200-800. Frequent amongst the limestone scars of the western dales. In Teesdale it descends to the débris below Cronkley Scars and ascends to the Main Limestone of Mickle Fell. In Swaledale it descends to Reeth and ascends to the plateau of Pinseat. In Yoredale it descends to Carperby and Aysgarth Force and ascends to the Main Limestone of Widdale Fell and Ten End. Analogous to *Arenaria verna* and *Sesleria cærulea* in its distribution within our limits. All the three are both Montane and Subxerophilous, are frequent amongst the western hills from a low level up to the Main Limestone Scars, and yet are entirely absent from both the two eastern ranges of hill. *Draba incana* is somewhat

similar in its rôle, but is less abundant, and does not descend so low as these three; *Hutchinsia* is their next nearest geographical ally, but does not ascend so high.

Galium tricorne With. Germanic type. Colonist. Area 7 6 5 . 3 2. Range 0-150. Not unfrequent in cultivated fields in the low country; Jerveaux, Thorp Arch, Bilton, Middlesbrough, Redcar, Thirsk, Cleves, Appleton, Barton, Malton, etc.

Galium spurium L. Alien. Casually subspontaneous with flax. In a flax field near Richmond; *James Ward*! With flax by the side of a foot-path near Thirsk, 1858.

Galium saccharatum L. Incognit. Reported by Sir J. E. Smith, on the authority of R. Miller, from Malton.

Galium Aparine L. British type. Native. Area general. Range 0-400. Common in cultivated fields and upon hedge-banks and in shaded places, ascending to the oat-fields of the Hambleton plateau, and in the west to the Main Limestone Scars of Preston and West Stonesdale Moors.

Galium boreale L. Highland type. Native. Montane. Area 9 8. Range 100-550. In Teesdale plentiful by the side of the stream from the White Force and the Falls of Maize Beck downwards by way of the High Force and Winch Bridge to Middleton; occurring also upon the limestone below Barnard Castle, and frequently carried down and establishing itself at points lower down the river as far as Middleton Locks and Yarm. In the Swale district upon Clink Bank Scars and by the side of the Gilling stream at Skeeby and Brompton. On the east it is reported by R. Teesdale from the neighbourhood of Helmsley, but has not been seen recently.

Sherardia arvensis L. British type. Colonist. Area general. Range 0-350. Common in cultivated fields, ascending as high as field-cultivation reaches.

Asperula odorata L. British type. Native. Area general. Range 0-350. Woods and shaded banks, common amongst the hills. I have seen it in the Central Vale in two places only,

a wood by the Tees side between Croft and Stapleton, and a hedge-bank between Cotcliffe and Northallerton. Plentiful in Askham Bogs; *J. Wheldon.*

Asperula Cynanchica L. English type. Native. Xerophilous. Area 6. Range 100. About the Magnesian Limestone by the Wharfe side at Thorp Arch. This is the most northern station for the species on the east side of Britain, but, unlike the generality of the Xerophilous species, it ascends further north on the west than on the east side of the island.

Asperula arvensis L. Casually subspontaneous in a forage-field near Camphill, 1858; *M. Hebblethwaite*!

Centranthus ruber DC. Alien. A species much cultivated in gardens, which is occasionally subspontaneous on old walls. Bolton Castle, Masham, Whitby, Helmsley, Strensall, etc. A native of Italy and the South of France.

Valeriana dioica L. English type. Native. Area general. Range 0-600. Frequent in damp places, ascending in Teesdale to the plateau of Cronkley Fell.

Valeriana officinalis L. with *V. sambucifolia* Mikan. British type. Native. Area general. Range 0-550. Frequent in ditches and damp places, ascending to Cronkley and White Force Scars and the Main Limestone cliffs of Punchard's Gill.

Fedia olitoria Vahl. British type. Colonist. Area 8 7 6 5 4 3 2 1. Range 0-250. Frequent in cultivated fields in the low country, ascending in Wensleydale to Carperby; and to Shawcote Scar, Askrigg; *J. Percival.*

Fedia carinata Stev. English type. Colonist. Area 8. Range 50. Sent by Umpleby from the railway embankment near Mawnby. The reported Wensleydale station seems to be quite unlikely for the plant.

Fedia Auricula DC. English type. Colonist. Area 2. Range 50. Found in plenty by T. J. Foggitt in cultivated fields between Thirsk and Sandhutton.

Fedia dentata Bieb. English type. Colonist. Area general. Range 0-200. Frequent in cultivated fields in the low country.

Dipsacus sylvestris L. English type. Native. Area general. Range 0-100. Not unfrequent in sandy ground in the low country. It is not anywhere plentiful, but has been noted in all the nine drainage districts. *D. Fullonum* is occasionally cultivated.

Dipsacus pilosus L. English type. Native. Subxerophilous. Area 8. Range 150. In Swaledale, found by James Ward in Whitcliff Wood near Applegarth. The most northern British station.

Scabiosa succisa L. British type. Native. Area general. Range 0-600. Common in grassy places both in the low country and amongst the hills, ascending to the plateau of Cronkley Fell.

Scabiosa columbaria L. Native. Subxerophilous. Area 9 8 7 6 5 4 3 2. Range 0-550. Frequent upon rocks and dry banks in the limestone country both east and west of the Central Valley, ascending to Boltby Scar, Hell Gill, and the Main Limestone cliffs of Harlen Fell, Booze Moor, and Copperthwaite Moor. In the Central Vale at Carthorpe, Thirsk, Leckby, and by the Tees side between Croft and Stapleton. About the Lower Oolite at Boltby and Welburn. In Cleveland on the basaltic dike at Langbargh, and amongst the sea-banks at Marske, Saltburn and Upgang. Analogous in its distribution within our limits to *Poterium Sanguisorba* and *Carlina vulgaris*, the three being the most widely diffused and commonest flowering plants with well-marked Xerophilous restriction which we have. *Anthyllis Vulneraria* and *Cerastium arvense* are perhaps as plentiful, but they are not so characteristically Xerophilous.

Knautia arvensis Coult. British type. Native. Area general. Range 0-300. Frequent in grassy places throughout the lower zone, ascending in Teesdale to Winch Bridge.

Tragopogon pratensis L. with *T. minor* Fries. British type. Native. Area general. Range 0-300. Frequent in

grassy places throughout the lower zone, ascending in Wensleydale to Carperby (*J. Percival*), in Swaledale to Gunnerside, and Arkengarthdale to Langthwaite.

Tragopogon porrifolius L. British type. Denizen. Area 5 3. Range 0-150. In Cleveland on the borders of fields on the Ayton slope of Cliff-rig; *W. Mudd*! At Scarborough it sprung up spontaneously in a plantation and continued for several years, but is now extinct; *W. Bean*! Reported also by Henry Ibbotson from the neighbourhood of Pickering.

Helminthia echioides Gærtn. English type. Native. Area 6 5 4 3. Range 0-100. About the Magnesian Limestone at Thorp Arch. Road-side between Marske and Upleatham. Frequent in dry sandy ground along the coast-line; South Stockton, Middlesbrough, Lazenby, Redcar, Marske, Ruswarp, Scarborough.

Picris hieracioides L. English type. Native. Area 9 8 . 6 5 . 3 2. Range 0-100. Not unfrequent on dry banks in the low country. About the western limestone at Middleton Tyas and Thorp Arch. On Mr. Handley Taylor's farm, Askham Bryan; *H. Ibbotson*. In the Central Vale to Carthorpe, Knavesmire, and by the Tees side at Cleasby. Hedge-bank between Dalton and Aislabeck, abundant; *W. Foggitt*. In Cleveland at Battersby and Teme Bridge. Along the Middle Oolite frequent from Rievaulx eastward by way of Hovingham and Castle Howard to Hackness and Scarborough.

Thrincia hirta Roth. English type. Native. Area 8. 6. 3 2 1. Range 0-100. Not unfrequent in dry sandy ground in the low country.

Apargia hispida Willd. English type. Native. Area general. Range 0-600. Common in grassy places, ascending in Widdale to the edge of the upper zone.

Apargia autumnalis Willd. British type. Native. Area general. Range 0-700. Common in grassy places, ascending nearly to the head of Punchard's Gill and to the slope of Mickle Fell towards the Cronkley plateau.

Hypochœris glabra L. English type. Native. Area 3. Range 0-100. In a sandy field near Rillington, with *Ornithopus*, etc.; *G. Webster*, 1888!

Hypochœris radicata L. British type. Native. Area general. Range 0-500. Common upon grassy banks, ascending in Teesdale to the falls of Maize Beck.

Lactuca virosa L. Germanic type. Native. Subxerophilous. Area 8 7 6 5 4 3 2 1. Range 0-150. In the west on the walls of Richmond Castle, Easby Abbey, and Jerveaux Abbey, and about the Magnesian Limestone at Thorp Arch. In the Central Valley in dry ground at Acomb, Rufforth, Skip Bridge, Tang Hall, Sandhutton, Thornton-le-Street, etc. In Cleveland at Stokesley and in Mulgrave Woods. On the east at Byland Abbey, Appleton-le-Street, and Cayton.

Lactuca muralis Less. English type. Native. Area general. Range 0-450. Frequent in woods and shaded places, especially amongst the hills, ascending to Upper Whitfield Force, Hell Gill, and the Main Limestone Scars of Harlen Fell, Copperthwaite Moor, and Punchard's Gill.

Sonchus arvensis L. British type. Colonist. Area general. Range 0-300. Common in cultivated fields throughout the lower zone, ascending to the oat-fields of the Hambleton plateau over Hawnby.

Sonchus asper Hoffm. British type. Native. Area general. Range 0-400. Common in waste ground, ascending to the Underset Limestone Scars of the western slope of Kisdon, and the Main Limestone Scars of West Stonesdale Moor.

Sonchus oleraceus L. British type. Native. Area general. Range 0-400. Common in waste ground, ascending, with the preceding, to Hook Mill Scar, Kisdon.

Crepis taraxacifolia Thuill. English type. Area 3. Range 0-100. In a limestone quarry at Hutton Bushell; *W. Bean, Jun.*!

Crepis virens L. British type. Native. Area general. Range 0-350. Common in cultivated fields and on grassy banks,

ascending to the Hambleton plateau above Boltby. *C. agrestis* W. & K. occurs occasionally in cultivated fields.

Crepis biennis L. Germanic type. Colonist. Area 5. Range 100. In Cleveland in cultivated fields near Great Ayton; *W. Mudd*!

Crepis succisæfolia Tausch. Intermediate type. Native. Montane. Area 9 . 7. Range 150-300. In Teesdale about the river at Winch Bridge and below Holwick, and I have gathered it also in fields at the lower part of Deepdale, within a mile of Barnard Castle. In Wensleydale in Bain Gill near Carperby; *J. Percival.*

Crepis paludosa Mœnch. Scottish type. Native. Montane. Area 9 8 7 . 5 4 3 2 1. Range 0-500. Common in damp woods in the dales and glens of both the eastern and western hills. It ascends to Blea Beck Scars, Hell Gill, Fossdale Woods, Upper Whitfield Force, and the Main Limestone crags of Punchard's Gill. Rare in the Central Valley; meadows at Thirsk and Aisenby, and woods by the Tees side at Croft.

Hieracium Pilosella L. British type. Native. Area general. Range 0-800. Common upon grassy banks, ascending to the Main Limestone of Mickle Fell and Cam Fell.

Hieracium aurantiacum L. Alien. Occasionally subspontaneous in parks and plantations. By the Tees near Wycliffe Hall; *James Ward.* In Cleveland in woods at Wilton; *W. Mudd*! Indigenous in France and Scandinavia.

Hieracium anglicum Fries. Highland type. Native. Montane. Area 9 8. Range 300-500. In Teesdale at the White Force and about the stream-side at the falls of Maize Beck and Winch Bridge. In the Swale district at Whitsundale, East Stonesdale and Cliff Gill, and near the Swale above Keld.

Hieracium iricum Fries. Highland type. Native. Montane. Area 9. Range 300-550. In Teesdale on Cronkley and the White Force Scars, and by the stream-side at the High Force and Winch Bridge.

Hieracium pallidum Biv. Highland type. Native. Montane. Area 9. Range 300-550. In Teesdale on Cronkley and Holwick Scars, and by the stream-side at Winch Bridge.

Hieracium Gibsoni Backh. Intermediate type. Native. Area 8 7. Range 200-300. On Yoredale limestone in Summersgill, Swaledale and one or two places in Wensleydale; *F. A. Lees*.

Hieracium murorum L., Backh. Monogr. ! British type. Native. Montane. Area 9 8 7 . 3 2. Range 100-450. Frequent in the western dales; Winch Bridge, Lunedale, Balderdale, Whitsundale, Kisdon, Gunnerside Gill, Arkengarthdale, Hell Gill, Cotterdale, Hardraw Force, Whitfield Gill, Tanfield, etc. On the east amongst the Hambleton Hills in several places; Hawnby Bank, Sutton Bank, Boltby Scars, etc.

Hieracium cæsium Backh. Monogr. ! non Fries, *H. Smithii* Baker. Scottish type. Native. Montane. Area 8 7 . 3 2. Range 100-500. With a similar range to the preceding, in company with which it often grows, but somewhat less frequent. In the west at Whitsundale Scars, Kisdon Force, Low Row, Gunnerside Gill, Arkengarthdale, Applegarth Scars, Downholme Scars, Harlen Fell Scars, Aysgarth Force, Leyburn Shawl, Gayle Beck near Hawes, Jack Wood, Penhill, Tanfield, etc. Amongst the Hambleton hills in the same stations as the preceding, and I have also seen it on the freestone crags near the head of Newtondale, and received it from Forge Valley (*F. Reynolds*).

Hieracium vulgatum Fries. British type. Native. Area general. Range 0-550. Frequent in woods and upon walls and rocks both in the low country and amongst the hills, ascending to Cronkley Scars and the Main Limestone cliffs of Booze Moor and Punchard's Gill.

Hieracium gothicum Fries. Highland type. Native. Montane. Area 9 8 7 . 5. Range 150-400. In Teesdale about the river at the High Force and Winch Bridge, and in Deepdale at the waterfalls. In the West Swale district on Whitsundale

Scars, the Main Limestone Scars of West Stonesdale Moor, and Hook Mill Scar near Keld. In Cleveland it has been found by William Mudd in Midnight Wood near Ingleby, and I have gathered a curious broad-leaved form in Lounsdale. A specimen from Wensleydale was in the herbarium of the late John Hardy, of Manchester.

Hieracium tridentatum Fries. English type. Native. Area 9 8 7 . 4 3 2 1. Range 0-400. Not unfrequent in woods from the Central Valley upwards to the middle zone. Winch Bridge, Whitsundale, Kisdon Force, Low Row, Feethams, Fossdale, Bain Gill, Mill Gill, woods north of Semmer Water, Aysgarth Force, Wensley, Croft, Hutton Moor, Woodend, Thirsk, Sutton-under-Whitstoncliffe, Guisbrough, Flazendale, Nettledale, Strensall Common, etc.

Hieracium prenanthoides Vill. Highland type. Native. Montane. Area 8 7. Range 300-450. In Swaledale in the woods on the northern slope of Kisdon from the Main Limestone scars down to the river. In the Yore district at Upper Whitfield Force. Abundant on banks of Yore near Cotterdale, and a single specimen on Eastholm Bridge; *J. Percival*. It grows on the south side of the Yore at Hackfall, just beyond our limits, at a much lower level than we appear to have it.

Hieracium crocatum Fries. Highland type. Native. Montane. Area 9 8 7 . 5. Range 250-400. Not unfrequent by the side of the dale streams in the west. About the Tees at Lower Cronkley, Winch Bridge and downwards to Middleton. In the West Swale district in Whitsundale, and near the Swale at Kisdon Force and below Crackpot Hall. In the Yore district at Gayle Force, Upper Whitfield Force, and in Fossdale Woods. In Cleveland in Midnight Woods near Ingleby.

Hieracium corymbosum Fries, *Hieracium rigidum* Backh. Monogr.! Highland type. Native. Montane. Area 9 8 7. Range 150-400. About the Tees at Lower Cronkley, Winch Bridge, and below Holwick. In the West Swale district in

Whitsundale, near Hudswell, and on Kirkby Hill near Ravensworth. In the Yore district in Fossdale Woods.

Hieracium boreale Fries. British type. Native. Area general. Range 0-400. Common in woods and upon heaths, ascending in Swaledale to Ravenseat, and in the Yore district to 1100 feet in Cotterdale; *J. Percival.*

Hieracium umbellatum L. British type. Native. Area general. Range 0-400. Frequent in similar situations to the preceding, and with the same vertical range.

Borkhausia setosa DC. Alien. Casually subspontaneous in cultivated fields. Sowerby, Carlton Miniott, Great Ayton, Seamer, Kirkby-in-Cleveland, etc.

Taraxacum officinale Wigg. British type. Native. Area general. Range 0-800. Everywhere common in waste and grassy places, ascending to the Main Limestone of Mickle Fell and Cam Fell. Of the segregate species we have *T. lævigatum*, *T. palustre* and *T. udum.*

Lapsana communis L. British type. Native. Area general. Range 0-350. Common upon hedge-banks and in cultivated fields throughout the lower zone, ascending in Arkengarthdale to Shaw Woods.

Cichorium Intybus L. English type. Colonist. Area 8.6 5 4 3 2 1. Range 0-200. Occasionally cultivated in the low country, especially in the neighbourhood of York, and not unfrequent in a subspontaneous state as a weed of cultivated ground. Skeeby, Catterick Bridge, Burniston, Ainderby Quernhow, Thorp Arch, York, Great Ayton, Eskdale-side, Thirsk, Sheriff Hutton, Heworth, wood above Byland Abbey, Barton, Malton, etc.

Arctium Lappa L. British type. Native. Area general. Range 0-400. Common in waste places and by road-sides throughout the lower zone, ascending to the plateau of the Hambleton range above Boltby, and the Main Limestone scars of West Stonesdale Moor. *A. minus* Schk. is the common

segregate species, and we have also *A. intermedium* and *A. pubens*. *A. majus* has never been found within our limits.

Serratula tinctoria L. English type. Native. Area 9 8 7 6 5 . 3 2 1. Range 0-300. Frequent in woods and fields amongst the hills, ascending in Teesdale to Winch Bridge. Rare in the Central Valley; Newby Carrs, Askham Bogs, Woodend, Sand Hutton, etc.; many places about Thirsk.

Carduus nutans L. English type. Native. Area general. Range 0-550. Frequent in waste ground both in the low country and amongst the hills, ascending to the peak of Booze Moor and the Main Limestone of Askrigg Moor.

Carduus acanthoides L. with *C. crispus* L. British type. Native. Area general. Range 0-300. Frequent in waste ground throughout the lower zone, ascending to the plateau of the Hambleton range over Hawnby.

Carduus tenuiflorus Curt. English type. Native. Maritime. Area 5 4. Range Coast-Level. Frequent along the coast line by way of Middlesbrough, Coatham, Redcar, Saltburn, and Whitby.

Carduus Marianus L. English type. Denizen. Area 9 8 7 6 . 4 3 2 1. Range 0-100. Not unfrequent in waste places in the low country. Lartington, Tanfield, Carthorpe, Dishforth, Aisenby, Thirsk, Acomb, Pilmoor, Mowthorpe Dale, Ayton (near Scarborough), etc. Upon the coast banks at Huntcliffe, Runswick Bay, and on the Scarborough Castle Hill.

Carduus lanceolatus L. British type. Native. Area general. Range 0-650. Common in waste ground, ascending to the Main Limestone of Cam Fell and Widdale Fell.

Carduus eriophorus L. English type. Native. Xerophilous. Area 8 . 6 . 3 . 2. Range 0-250. About the Magnesian Limestone at Thorp Arch. In the Central Valley at Kirklington, Leckby, and Thorpfield. Along the Middle Oolite, frequent from Old Byland and Helmsley by way of Oswaldkirk, Hovingham, and Pickering to Hackness and Scarborough.

Carduus palustris L. British type. Native. Area general. Range 0-700. Common in damp places both in the low country and amongst the hills, ascending to the peak of Nine Standards Rigg and the limestone pavement of Widdale Fell.

Carduus arvensis Curt. British type. Native. Area general. Range 0-700. Common in fields and waste places, ascending to the Main Limestone of Cam Fell and nearly to the summit of Widdale Fell.

Carduus acaulis L. English type. Native. Xerophilous. Area 3. Range 200-250. On the Harriot Air near Rievaulx, discovered lately by John Foggitt, of Thirsk, and Alfred Wilson, of Bradford.

Carduus pratensis Huds. English type. Native. Area 6 . 3 2 1. Range 0-100. In several places amongst the heaths of the Central Valley. Pilmoor, Askham Bogs, Buttercrambe Moor, and on Stockton Forest between Strensall and Hazel Bush.

Carduus heterophyllus L. Scottish type. Native. Montane. Area 9 8 7 . 3. Range 150-400. Frequent in damp places in the western dales, ascending to Ravenseat and Fossdale Woods, descending to Greta Bridge, Marske, and Aysgarth Force. Amongst the eastern hills in the upper part of Newtondale.

Onopordum Acanthium L. Alien. Subspontaneous in waste ground at Camphill; *M. Hebblethwaite*! Thorp Arch Woods, probably introduced by the late Mr. Hadfield; *J. Emmet.*

Carlina vulgaris L. English type. Native. Subxerophilous. Area 9 8 7 6 5 4 3 2. Range 0-400. Frequent in the limestone country both upon the west and the east of the Central Valley, and occasionally upon the Gritstone and Lower Oolite, as at Guisbrough, Levisham, and in Gurtof Gill. In the Central Valley at Burniston, Kirklington, and by the Tees side near Dalton. Amongst the coast sand-hills at Redcar, Marske, Saltburn, Sandsend, and Whitby.

Centaurea montana L. Alien. Casually subspontaneous in Swaledale near the Round Howe; *James Ward.* A native of France and Belgium.

Centaurea nigra L. British type. Native. Area general. Range 0-550. Common in grassy places, ascending to the White Force scars, and the Main Limestone cliffs of Kisdon and Copperthwaite Moor. The radiate form is not unfrequent.

Centaurea Cyanus L. British type. Colonist. Area 8 7 6 5 4 3 2. Range 0-100. Not unfrequent in cultivated fields in the low country.

Centaurea Scabiosa L. British type. Native. Area 9 8 7 6 5 4 3 2. Range 0-300. Frequent upon dry banks throughout the lower zone, ascending to the summit of Leyburn Shawl.

Centaurea Calcitrapa L. Incognit. A specimen from Sandsend is in the Middleton Herbarium in York Museum, but the species has not been seen recently.

Centaurea solstitialis L. Alien. Casually subspontaneous in cultivated fields at Leeming Lane; *T. Simpson*!

Centaurea melitensis L. Alien. Below Yore Mills, Aysgarth, plentiful in 1884-5; *F. Arnold Lees.*

Calendula officinalis L. Alien. An occasional straggler from garden cultivation. Middleton Tyas, Carperby, Carlton Miniott, Esk side near Lealholme Bridge, etc. A native of Spain and Italy.

Bidens cernua L. English type. Native. Area 8 . 4 3 . 1. Range 0-100. Watery places in the low country, rare. Bolton-on-Swale, Kirklington, Camphill, Swainby, Mawnby, Sheriff Hutton, Castle Howard, Cayton Carr, and Strensall.

Bidens tripartita L. English type. Native. Area 8 . 5 4 3 2. Range 0-150. In similar situations to the preceding, and somewhat more frequent. Bolton-on-Swale, Camphill, Mawnby, Newton (Cleveland), Castleton, Thirlby, Woodend, Sandhutton, Bulmer, Terrington, Raincliffe Wood near Scarborough.

Eupatorium cannabinum L. British type. Native. Area general. Range 0-200. Frequent in watery places in the low country, ascending to Kepwick and Aysgarth Force.

Tanacetum vulgare L. British type. Native. Area general. Range 0-200. Frequent by stream-sides and in waste ground in the low country, ascending in Bilsdale to Chop Yate. Cultivated in gardens up to 350 yards.

Artemisia maritima L. English type. Native. Maritime. Area 5 4. Range Coast-Level. Along the coast-line, frequent at Middlesbrough and Coatham, and more sparingly at Saltburn and about the Esk at Whitby.

Artemisia Absinthium L. English type. Denizen. Area general. Range 0-250. Frequent in waste places in the lower zone, but so far as I have seen, always in the neighbourhood of houses and gardens. Ascends to Middleham Moor; *W. Whitwell.*

Artemisia vulgaris L. British type. Native. Area general. Range 0-300. Frequent in hedge-rows and waste ground throughout the lower zone, ascending in Gretadale to Bowes, and in Arkengarthdale to Langthwaite.

Gnaphalium dioicum L. Scottish type. Native. Montane. Area 9 8 7 6 5 4 3 2. Range 100-600. Frequent in grassy places amongst both the eastern and western hills, ascending to the sugar limestone of Cronkley Fell, descending to Thorp Arch, Rievaulx Terrace, and the peaks of the Howardian tract.

Gnaphalium margaritaceum L. Alien. A common garden plant which is subspontaneous in two or three places. By the Swale side near Whitcliffe Mills; *James Ward*; and lower down near Brompton; *T. Simpson.* Amongst the coast cliffs about three miles south of Scarborough; *A. O. Black*!

Gnaphalium sylvaticum L. British type. Native. Area 8 7 6 5 4 3 2 1. Range 0-300. Frequent upon grassy heaths throughout the lower zone.

Gnaphalium uliginosum L. British type. Native. Area general. Range 0-300. Frequent in cultivated fields and damp places in the low country. Ascends Wensleydale to Hawes; *J. Percival.*

Filago minima Fries. British type. Colonist. Area 8 7 6 . 3 . 1. Range 0-150. Sandy fields in the low country, rather rare. Bedale, Hutton Moor, Acomb, Stockton, Strensall, Yearsley Moor, Scarborough, Pilmoor.

Filago germanica L. British type. Colonist. Area 8 7 6 5 4 3 2 1. Range 0-300. Common in cultivated fields throughout the lower zone, ascending to the flagstone quarries of Leyburn Moor.

Petasites vulgaris Desf. British type. Native. Area general. Range 0-300. Common in damp places and about streams throughout the lower zone, ascending to Hawes, Lonton, and Shaw Wood in Arkengarthdale.

Petasites fragrans Presl. Alien. In the wood at Thorp Arch, on rocky banks near the river, half-way between Flint Mill and the bridge, in plenty; *F. Arnold Lees.*

Tussilago Farfara L. British type. Native. Area general. Range 0-600. Common in waste places, ascending to the plateau of Cronkley Fell and above the Main Limestone in Punchard's Gill.

Erigeron acris L. English type. Native. Area 8 7 6 . 3 2. Range 0-100. Dry banks in the low country, rare. In the West Swale district at Easby Abbey, and about the Magnesian Limestone at Well and Thorp Arch. In the Central Valley at Carthorpe, Camphill, Newby Wiske, Newsham, Dishforth, and Thirsk. On the Middle Oolite at Malton, and between Helmsley and Brandsby.

Aster Tripolium L. British type. Native. Maritime. Area 5 4. Range Coast-Level. Plentiful about the salt-water ditches at Middlesbrough and Coatham. Banks of the Esk at Whitby.

Aster puniceus L. Alien. Well-established on the Yorkshire side of the Tees about mid-way between Yarm and Low Worsall, where it was first noticed many years ago by T. J. Foggitt. It now extends for a couple of yards along the bank of the river. I am not quite certain about the name, but believe the plant to be a narrow-leaved form of the American *A. puniceus.*

Solidago Virgaurea L. British type. Native. Area general. Range 0-550. Frequent amongst the hills of both east and west, especially by the stream-sides where they break through the limestone. It grows also in the Howardian tract, upon the basaltic dike in Cleveland, and amongst the coast banks at Mulgrave, Robin Hood's Bay, and Scarborough. In the Central Valley I know of it in one station only, a wood by the Tees side at Stapleton. It has been found lately by A. R. Waller in small quantity at Sandburn and Strensall.

Senecio vulgaris L. British type. Native. Area general. Range 0-400. Common in waste places, ascending to Upper Cronkley, Sleightholme, and Keld.

Senecio sylvaticus L. British type. Native. Area general. Range 0-300. Frequent upon sandy heaths throughout the lower zone, ascending to the flagstone quarries of Leyburn Moor. *S. viscosus*, except as an Alien, is quite doubtful as a plant of our limits.

Senecio erucæfolius L. English type. Native. Area general. Range 0-200. Frequent upon hedge-banks in the low country. Ascends Wensleydale to Carperby; *J. Percival.*

Senecio Jacobæa L. British type. Native. Area general. Range 0-550. Common in fields and about road-sides, ascending to the Main Limestone of Askrigg Moor and the limestone plateau of Kisdon.

Senecio aquaticus Huds. British type. Native. Area general. Range 0-400. Common in damp places, ascending nearly to the head of Coverdale, and in Gretadale to Sleightholme.

Senecio saracenicus L. Intermediate type. Denizen. Area 7. Range 350-400. In the West Swale district about a barn at the bottom of Whitsundale, and abundant near a farm-house called Close Hills in the same dale. With us evidently an introduced species, but now well established. Formerly in repute as a woundwort, and anthelmintic for cows and horses.

Senecio (Cineraria) campestris DC. English type. Native. Area 9. Range 400-600. Near the southern boundary of the Upper Teesdale range, on mountain limestone, at an elevation of 1,200 to 1,800 feet; *J. Backhouse, junr.* (See Babington, in Journ. of Bot., 1882, p. 35).

Doronicum Pardalianches L. Alien. Occasionally subspontaneous in the neighbourhood of parks and gardens. Lartington, Marske, Swinton, Tanfield, Warlaby, Holme, Thirsk, Great Ayton, Pinchinthorpe, Mulgrave Woods, etc.

Doronicum plantagineum L. Alien. Like the preceding, but rare. At Leyburn near the bleach yard; *James Ward.* In a wood at Kirklington; *T. Simpson*! Beneath the trees near the lodge on the Foss side of Newburgh Park.

Inula Helenium L. English type. Native. Area 6 5 4 3 2 1. Range 0-150. In the Central Valley at North Kilvington (station now enclosed), and near the Ouse at Overton. Amongst the eastern hills truly wild in several places; Slip Gill near Rievaulx, Goathland Dale, Grosmont, Newtondale, Mulgrave Woods, Mowthorpe Dale, Hayburn Wyke. Hedge between Thorp Arch village and the church; *J. Emmet.*

Inula Conyza DC. English type. Native. Xerophilous. Area 6 . 3. Range 0-100. About the Magnesian Limestone by the Wharfe side at Thorp Arch, and on the Middle Oolite at the east end of Cawklees Wood near Nunnington.

Pulicaria dysenterica Gærtn. English type. Native. Area general. Range 0-200. Common in damp places in the low country, ascending to Cotherstone and the upper part of Newtondale.

Bellis perennis L. British type. Native. Area general. Range 0-800. Everywhere common in grassy places, ascending to the Main Limestone of Cam Fell and Mickle Fell.

Chrysanthemum segetum L. British type. Colonist. Area 8 7 6 5 4 3 2. Range 0-100. Not unfrequent as a weed of cultivated fields in the low country. Sinderby, Skipton Bridge, Howe-upon-Swale, Thorp Arch, Breckenborough, Thirsk, Great Ayton, Sutton-on-Derwent, Malton, etc.

Chrysanthemum Leucanthemum L. British type. Native. Area general. Range 0-400. Common in grassy places, ascending to Upper Cronkley and Ravenseat.

Pyrethrum Parthenium Smith. British type. Denizen. Area 9 8 7 6 5 4 3 2. Range 0-250. Frequent upon hedge-banks and in waste ground, but always in the vicinity of gardens and farm-houses. Commonly cultivated in cottage gardens up to 350 yards.

Pyrethrum inodorum Smith. British type. Native. Area general. Range 0-300. Common in cultivated fields and waste ground, ascending from the Coatham salt-marshes to the flagstone quarries of Leyburn Moor.

Matricaria Chamomilla L. English type. Colonist. Area 8 . 6 . 3 2. Range 0-100. Not unfrequent in cultivated fields in some parts of the low country.

Anthemis nobilis L. English type. Native. Area 6 . 4 3. Range 0-100. Sandy and grassy places, rare. Terrington Common; *R. Teesdale.* Lastingham near Pickering; *Flora.* By the Esk side below Ainthorp Bridge. Thorp Arch; *T. Scatcherd.*

Anthemis arvensis L. English type. Colonist. Area general. Range 0-300. Frequent in cultivated fields throughout the lower zone, ascending to the plateau of the Hambleton range above Hawnby.

Anthemis Cotula L. English type. Colonist. Area general. Range 0-300. Equally frequent to the preceding in similar situations, and with the same vertical range.

Anthemis tinctoria L. Alien. Seed-field at Dowbar, Thirsk, 1871; *W. Foggitt.*

Achillea Ptarmica L. British type. Native. Area general. Range 0-750. Common in grassy places, ascending to the slope of Mickle Fell towards the Cronkley plateau.

Achillea Millefolium L. British type. Native. Area general. Range 0-800. Common in grassy places, ascending to the Main Limestone of Mickle Fell and Cam Fell.

Achillea tomentosa L. Alien. A casual straggler from garden cultivation. Stokesley; *W. Mudd*! A native of Spain and the south of France.

Campanula rotundifolia L. British type. Native. Area general. Range 0-800. Common in grassy places, ascending to the Main Limestone of Mickle Fell, Widdale Fell, and Cam Fell.

Campanula patula L. English type. Native. Area 5 4. Range 0-100. By the Tees side near Yarm; *T. J. Foggitt*! By the Esk side near Ruswarp; *W. Mudd*!

Campanula Rapunculus L. English type. Denizen. Area 5. Range 150. In Cleveland on hedge-banks on the Ayton slope of Cliff Rig; *W. Mudd*! Reported also from Forge Valley.

Campanula latifolia L. Scottish type. Native. Area general. Range 0-400. Frequent in damp woods and by stream-sides, ascending to Fossdale Woods, Hunter's Hall in Coverdale, and the Main Limestone scars of West Stonesdale Moor. The most decided example of a species of the Scottish type of distribution which is frequent in the low country which we have.

Campanula rapunculoides L. Alien. Not unfrequent as a garden weed and occasionally subspontaneous in waste ground. Scruton, Thirsk, Great Ayton, etc.

Campanula glomerata L. Germanic type. Native. Sub-xerophilous. Area 8 7 6 . 3 . 1. Range 0-250. Amongst the western limestones at Richmond, Aysgarth, Thornton Watlass,

and Nosterfield. In the Central Valley in sandy ground in several places; Kirklington, Bedale, Dishforth, Picton, Ainderby Steeple, South Stockton, Northallerton, Askham Bryan, Thornton-le-Street, and near the Ouse along Clifton Ings. Amongst the limestone hills of the east, ascending to the Hambleton plateau near Hawnby, and frequent about Hovingham and Malton. About the arenaceous Howardian terrace at Welburn, Ganthorpe, and Terrington. It is sometimes a plant of grassy places and dry banks, sometimes of corn-fields. Allied in its distribution to *Cerastium arvense* and *Anthyllis*.

Campanula Trachelium L. English type. Native. Area 3. Range 100. In the Howardian tract in Mowthorpe Dale; *R. Spruce*.

Campanula persicifolia L. Alien. Subspontaneous or planted on the north side of the Wharfe at Thorp Arch; *S. Hailstone*.

Specularia hybrida A.DC. Germanic type. Colonist. Area 7 6 5 . 3 2. Range 0-100. Not unfrequent in cultivated fields in the drier tracts. Fencote, Tanfield, Thorp Arch Howgrave, Wath, Norton Conyers, Great Ayton, Thirsk, Sandhutton, Welburn, Barton, Appleton, Coneysthorp, Hovingham, etc.

Specularia speculum A.DC. Alien. Casually subspontaneous in cultivated fields. Fallow field, between Thirsk and the railway station, 1854. Field between Sandhutton and Carlton Miniott, 1858; *T. J. Foggitt*! A common agrestal weed of France and Germany.

Jasione montana L. British type. Native. Area 7 . 3 2 1. Range 0-250. Sandy ground, rare. Wensleydale; *J. Fothergill*. Hutton Moor; *James Ward*. Howe Carr near Sandhutton; *T. J. Foggitt*! On Terrington Broats and by the side of the road from Huntington to Strensall Common; *Henry Ibbotson*. Rather plentiful in lanes about Strensall Common and on the paths across it; *A. R. Waller*. Upon the Hambleton plateau near the head of Yowlasdale.

Erica Tetralix L. British type. Native. Area 9 8 7 . 5 4 3 2 1. Range 0-750. Common upon heaths, ascending to the peak of Lovely Seat. It is much more abundant than *E. cinerea* both upon the vale heaths and in the upper zone, and the two added together are very much less plentiful than *Calluna*.

Erica cinerea L. British type. Native. Area 9 8 7 . 5 4 3 2 1. Range 0-650. Common upon heaths throughout the Agrarian region.

Calluna vulgaris Salisb. British type. Native. Area general. Range 0-850. Everywhere common upon heaths, ascending from the vale heaths to the summits of all the higher hills. Several hundreds of square miles are mainly covered with this species, and there are extensive tracts of it in all the districts except the Ainsty.

Andromeda polifolia L. Intermediate type. Native. Area 9 . 1. Range 0-500. Strensall Common, on the side nearest Stockton, where it was found long ago by R. Spruce, and has been gathered recently by B. B. LeTall. On a high fell nearly a mile from the old station of *Saxifraga Hirculus* in Balderdale, discovered in 1884 by W. Foggitt, of Thirsk, and A. Smith, of Durham.

Arbutus Uva-ursi L. Highland type. Native. Montane. Area 9 . 3. Range 350-500. In Teesdale on Cronkley and Bleabeck scars, and by the stream-side above the High Force. Abundant amongst long ling on the hills between Levisham and Cawthorne Camps; *Robert Braithwaite.*

Vaccinium Myrtillus L. British type. Native. Area 9 8 7 . 5 4 3 2 1. Range 0-850. Common in heathy places, ascending from the vale heaths to the peaks of most of the higher hills.

Vaccinium uliginosum L. Incognit. Mentioned in Fothergill's list of Wensleydale plants, but not otherwise known to me as a North Yorkshire species. It occurs in Teesdale upon the Durham side of the river.

Vaccinium Vitis-idæa L. Highland type. Native. Montane. Area 9 8 7 . 5 4 3 2. Range 150-850. Frequent in heathery ground amongst the higher moorlands of both east and west, ascending from nearly the level of Boltby in Gurtof Gill to the peaks of Mickle Fell, Great Whernside, and Lovely Seat.

Vaccinium Oxycoccus L. British type. Native. Montane. Area 9 8 7 . 4 3 . 1. Range 0-700. Amongst the hills of both east and west in swamps in numerous localities. Cronkley Fell, Nine Standards Rigg, Lovely Seat, Widdale Fell, Coverdale Moors, Penhill, Loose Howe Moor, etc. In the Central Valley in Tanfield Hall Carr, and abundant in Leckby Carr. In the Howardian tract in Terrington Carr, and on Scakleton Moor. Upon the plateaux of the eastern calcareous range over Hawnby, Seamer, and Falsgrave. In the Central Valley on the east side of Strensall Common; *A. R. Waller.*

Pyrola rotundifolia L. Germanic type. Native. Montane. Area 9 . 3. Range 50-150. In the Central Vale plentiful in Halnaby Carr near Croft, where it was first noted by Woods. Upon the escarpment of the eastern calcareous hills near Hutton Bushel; *Bean*!

Pyrola media Swartz. Scottish type. Native. Montane. Area 7 . 4 3 2. Range 0-150. In the Central Valley in fir woods at Breckenborough and on Hutton Moor. Amongst the eastern hills in Mulgrave Woods, and in a fir plantation below Cawthorpe Camps (*S. Anderson*); in Beckdale Woods near Helmsley (*J. H. Phillips*); and near Hackness on the slope of Sawdon Moor and Hutton Bushel Moor, and in a wood at Whisperdales; *Bean*!

Pyrola minor Swartz. Scottish type. Native. Montane. Area general. Range 0-300. Frequent in fir woods, especially in the heathery hilly portions of the lower zone. In the Central Vale in woods between Sessay and Sowerby, and on Stockton Forest. Quaker's Wood, Dringhouses; *G. Webster.*

THE

TRANSACTIONS

OF THE

YORKSHIRE NATURALISTS' UNION.

Museum of Comparative Zoology
OCT 11 1944
LIBRARY

PART 16,

Issued to the Members for the year 1890.

CONTENTS.

Series C—INVERTEBRATA (excl. Articulata)—Sheet 5.

Annotated List of the Land and Freshwater Mollusca of Yorkshire.
W. NELSON and JNO. W. TAYLOR, F.L.S., pp. 65—80 (Physa—Limnæa).

Series D—ARTICULATA—Vol. III, Sheet 4.

List of the Coleoptera of Yorkshire, by REV. W. C. HEY, M.A.

DYTISCIDÆ (concluded), pp. 49—50.
GYRINIDÆ, pp. 50—51. HYDROPHILIDÆ, pp. 51—55.
SPHÆRIDIIDÆ, pp. 55—57. STAPHYLINIDÆ, pp. 58—64.

Series E—BOTANY—Vol. I, Sheets 18, 19, 20.

First Supplement to the Flora of Dewsbury and Neighbourhood, by P. FOX LEE.—pp 249—264.

Report on Yorkshire Botany for 1885.
PHANEROGAMIA, by P. FOX LEE, pp. 267—269.

Proceedings of the Botanical Section, pp. 270 and 278.

Report on Yorkshire Botany for 1886.
PHANEROGAMIA, by P. FOX LEE, pp. 271—272.

Report on Yorkshire Botany for 1887.
PHANEROGAMIA, by P. FOX LEE, pp. 273—277.

Report on Yorkshire Botany for 1888.
PHANEROGAMIA, by P. FOX LEE, pp. 279—280.

Title-page and Index, pp. 281—292.

Appendix—METEOROLOGY (six sheets).

Meteorology of Bradford for 1888, 1889, and 1890.
By JOHN MCLANDSBOROUGH, F.R.A.S., F.R.Met.S., F.G.S. and ALFRED ELEY PRESTON, M.Inst.C.E., F.R.Met.S., F.G.S. (presented by the authors).

Appendix—REPRINTS of EXCURSION CIRCULARS.

72nd Meeting—Leyburn, May 21st, 1888.
73rd Meeting—Saddleworth, June 16th, 1888.
74th Meeting—Robin Hood's Bay, July 16th.
75th Meeting—Market Weighton, Aug. 6th.
78th Meeting—Holmfirth, June 10th, 1889.
79th Meeting—The Peak, June 21st, 1889.
80th Meeting—Rudding Park, July 13th, 1889.
81st Meeting—Upper Teesdale, Aug. 5th, 1889.
82nd Meeting—Kirkham Abbey, Sept. 4th, 1889.
84th Meeting—Lowthorpe, May 26th, 1890.
85th Meeting—Bretton Park, June 14th, 1890.
86th Meeting—Kildale, July 12th, 1890.
87th Meeting—Upper Swaledale, Aug. 4th, 1890.
88th Meeting—Malham, Sep. 11th, 1890.
90th Meeting—Leckby Carr, May 18th, 1891.
91st Meeting—Grass Wood, June 20th, 1891.
92nd Meeting—Hayburn Wyke, July 11th, 1891.
93rd Meeting—York Dale and Sledmere, Aug. 3.
94th Meeting—Edlington and Wadworth, Sep. 17th, 1891.

Appendix—26th, 27th, 28th, and 29th ANNUAL REPORTS.

LEEDS: TAYLOR BROS., PRINTERS, SOVEREIGN STREET.

NOVEMBER, 1891.

Y. N. U. TRANSACTIONS.

NOTICE TO BINDER.

COMPLETION OF A VOLUME.

The Title-page and Index included in this part completes the 1st Volume (Miscellane Papers and Reports) of the Botanical Series of the Transactions. The sheets are as follow

Part 1 (1877)	includes sheet	E1,	pp. 1— 8
,, 2 (1878)	,,	E2, E3, E4,	,, 9— 56
,, 4 (1879)	,,	E5, E6, E7,	,, 57—104
,, 5 (1880)	,,	E8,	,, 105—120
,, 7 (1882)	,,	E9, E10,	,, 121—152*
,, 8 (1883)	,,	E11, E12, E13	,, 153—200
,, 9 (1884)	,,	E14, E15,	,, 201—224
,, 10 (1885)	,,	E16, E17,	,, 225—248
,, 16 (1890)	,,	E18, E19, E20,	,, 249—end

Part 5 also includes PLATE 1 (Carex saxumbra), which is to be inserted oppos page 123.

*NOTE.—The signatures are wanting to sheets E 9 and E 10, which therefore must collated by their pagination.

The Volume to be lettered **Bot. Trans. Y.N.U. Vol. 1.**

Vol. 2 of the Botanical Transactions is the 'FLORA OF WEST YORKSHIRE,' by F. ARNO LEES, published by subscription.

Vol. 3 (now in progress) is the Second Edition of 'NORTH YORKSHIRE,' by J. G. BAKE F.R.S.

.....1891

To Mr. A. D. H. Leadman, F.S.A.

Boroughbridge,

York.

Sir,

I will take.....cop.....

of your 'Prœlia Eboracensia,' *and*

enclose Postal Orders for.....the

Subscription price.

Address.....

.....

.....

Prælia Eboracensia.

Battles fought in Yorkshire

Treated historically and topographically from original and contemporary sources

BY

ALEX. D. H. LEADMAN, F. S. A.,

Being a series of Papers reprinted from the *Yorkshire Archæological Journal*, carefully revised and containing additional information with plans and illustrations.

The Book will *very shortly* be issued to Subscribers *only*, *at 6/6 each*, and as the number of copies will be limited, early application should be made.

MUSEUM OF COMPARATIVE ZOOLOGY
OCT 11 1945
LIBRARY

80424

Genus PHYSA Lamarck.

This group is a connecting link between Planorbis and Limnæa, having amongst other peculiarities the setaceous tentacles of Planorbis and the elongate spiral shell of Limnæa, though the latter is coiled dextrally and not sinistrally as in Physa. The shells of the Physæ are unusually brilliant and glossy, which circumstance Dr. Jeffreys ascribed in some degree to lubrication by the mantle lobes, apparently overlooking the fact that of our two species, *P. hypnorum* usually presents the most polished appearance, though quite deficient of the extended mantle-lobes characterizing *P. fontinalis*. The Physæ are very active mollusks and are the greatest adepts at forming mucus-threads, which they freely use for ascending to the surface or descending to the bottom of the water. The species of this genus are said to be partial to clear and shallow water.

The genus is a very ancient one, species having been recorded from the Middle Purbeck Bed in the Secondary formation.

As in Planorbis, the species of this group do not ascend generally the western dales, but principally congregate in the low lying lands.

Our two species belong to separate sections, which differ by the presence or absence of the extended and digitate mantle lobes, and in our opinion are sufficiently distinct to be elevated to full generic rank.

Physa fontinalis (L.).

Locally common.

Turbo adversus Da Costa.
Lymnæa labrosa Risso.

This is a very active mollusk, and by most authors stated to be almost restricted to pure water, but Lindstrom has collected it at depths varying from 18 to 36 feet in the brackish water of the Skärgard at Stockholm, which is an arm of the Baltic.

According to our experience, extending over several years, the full-grown animals of this species die off during the latter part of July and beginning of August.

The body of this species is very bulky, quite double the length of the shell, within which it is almost too large to be concealed. It is affected by an Infusorian (*Scyphidia physarum* Claparede and Lachmann) which attaches itself to the skin.

P. fontinalis has been stated by Turton, Gwyn Jeffreys, and others to be normally destitute of epidermis, but this is incorrect, as all our native mollusks have this covering. It is a species much addicted to spiral banding, but these linear revolving whitish lines are not true colour bands, but probably owing to defective secretion of epidermis, caused by injuries to the margin of the mantle.

It has been observed to vary in length from 6 to 15 mill., the latter being the size of Locard's var. *major* and Colbeau's var. *aplexoides*, which latter seems to connect this species with *P. hypnorum*, so far as the shell is concerned.

It is widely distributed in the Palæarctic region and has been reported from Siberia by Westerlund, as well as from the Atlantic Islands, but the specimens from the latter locality have been differentiated by M. Bourguignat as *Physa canariensis*. The *P. tasmanica* Tenison-Woods from Van Diemen's Land also is stated by the sponsor to be probably identical with the present species. In the British Isles Jeffreys gives the distribution as everywhere in Great Britain as far north as Aberdeenshire, but Mr. Baillie, of Brora, tells us that the keeper of the Duke of Sutherland's Museum informs him that the late Dr. Gunn found this species in Sutherland, and Da Costa, in his work published

in 1778, records this species on the authority of Mr. Wallace, under the name of *Turbo adversus*, as common in the small rivulets in the Orkneys.

It has been recorded from several localities in North America by G. B. Sowerby, Michaud, and others, but its occurrence in these regions has not been confirmed by recent observers.

This species is stated by Mortillet to be Risso's *L. labrosa*, but the specimens are now missing from that collection.

Dr. Martin Lister, in 1678, was the first to record this species for our county.

2. ***Lune and Ribble***—Abundant amongst *Anacharis*, pond, Gisburn-in-Craven, April 18th, 1881, W.D.R. !

3. ***Vale of York***—Decidedly less common than *P. hypnorum* about York. Unusually fine in the Foss, near Huntington, Rev. W. C. Hey, also found at Askham, Bishopthorpe, and many other places, R. M. Christy, 'Zool.,' p. 183, 1881; found plentifully in the stream south of Heyworth, near York, and frequent elsewhere in still waters (Dr. Martin Lister, 1678); in the reedy ditch-expansion by the left bank of the Foss above Yearsley Bridge, 1858 ! and ditch near the Ouse below York, 1866, W. Whitwell ! ditches on Middlethorpe Ings, near York, 1865, R. Whitwell; common at Askham Bog, June 2nd, 1879, W.D.R. ! Boston Spa, tolerably common, J. Emmet, 1882; Bishopdyke, at Barkston ! and at Sherburn, April, 1879 ! Malton, Sept. 23rd, 1880, J.D.B. ; pond near Church Fenton Station ! grassy pond, Towton Battle Field ! pond at Scarcroft, June 14th, 1884, W.D.R. ! Tadcaster, 1877, H.C. ! Pond, Riccall, June, 1879! Old Crimple near Spofforth, rather common, 29th Sep., 1889 !

4. ***Humber***—Goole district, R. D. Maxwell, 1876; in the drains about Castleford and Fairburn, June 15th, 1885, amongst Canadian weed, some very much ridged in the line of growth, and large, G. Roberts; stream, Ermine Street, Castleford, formerly abundant, now scarce; pond near Fryston Church, April 2nd, 1877 ! Ferry Fryston ! Fairburn, W. H. Broadhead, 1870; Newthorpe, Feb. 12th, 1882 ! canal near Selby, June, 1879; Burton Hall, Oct. 17th, 1880 ! abundant in ditch alongside Selby cut, August, 1875 ! Hemingborough ! ditch near Bond's Ings, South Milford, 1879 ! pond near Howden Station ! ditch, Barlow Common, August, 1881 ! Carlton pond, near Snaith, June 17th, 1882 !

5. ***Hatfield and Thorne***—West Moor Drain, Hatfield Chace, a few, 21st Sep., 1887, W.D.R. ! Thorne Waste, May 30th, 1888 (Nat. Hist. Journ., Oct. 15th, 1888, xii, 158).

6. ***Trent***—Doncaster, June 28th, 1877! Gravel Drain! and abundant in ditch alongside Black Bank Drain, April 14th, 1883, W.D.R.! abundant in ditches, Ackholme! and in River Torne, May 14th, 1883! and in ditches near Blaxton Grange! Potteric Carr, J. Emmet, 1882; Auckley Common! Chesterfield Canal near Kiveton Park Station, April 30th, 1885, W.D.R.!

7. ***Went Vale***—River Went, J. Wilcock, 1883; Pond, Norton, April 22nd, 1878! Bentley, near Doncaster, 1877! West Cowick, near Snaith, in a brick-pond thickly covered with *Lemna gibba*, June 17th, 1882, W.D.R.! Ackworth, generally distributed, C. Ashford, 1874; mill dam, Ackworth, on the wall near the house, G. F. Linney; Ackworth, mill pond, H. Richardson, 1883; common in canal at Wintersett, also in mill stream, W. E. Brown, 1880.

11. ***Upper Calder***—A specimen found near Brighouse a few years ago, by Mr. Ibbetson Walker, Halifax, Hobkirk's Nat. Hist. of Huddersfield, 1868, p. 224; Halifax, March 1877, H.C.! Elland Wood, J. Conacher, 1877.

12. ***Lower Calder***—Common in Barnsley canal, and in nearly every stream throughout the district, J. Hebden, 1874; Pugneys, J. Wilcock, 1883; Crigglestone! Sharlston Common, Feb., 1887!

13. ***Airedale***—Pond nr. Killingbeck lake, common 1870! pond, Black Hills, York Road, Leeds, June 28th, 1883! Roundhay Park lake, 1879! water trough, Halton! Newsam Green near Woodlesford, 1872, H. Shaw! pond nr. Haigh Park, Hunslet, June 1882! stream, Allerton Bywater, March 1881! common at Lofthouse, G. Roberts, Nat. Hist. and Topog. of Lofthouse, 1882! Roundhay and Seacroft, T. W. Bell, Leeds, Merc. Suppl., April 22nd, 1882.

14. ***Malhamdale***—Skipton! (in collection of T. Rogers, Manchester).

17. ***Wensleydale***—Pond, Staveley, 1876! Eavestone, near Ripon, quite local and not numerous, 1882! and Ripon Canal, not very common, Feb. 1883, J. Ingleby! Skelton, near Ripon, April 1884! Sharow Mires, not common, H. H. Slater, 1885! By the river [Ure]-side after a flood, Rev. James Dalton, 1859.

18*a*. ***Vale of Mowbray***—Vale of Mowbray, Grainge, 'Vale of Mowbray,' 1859, p. 38; Wood-end brick ponds, G. R. Baker; frequent in ditches at Newsham Carr, J. H. Davies, Nat., p. 136, 1855.

20. ***Lower Tees***—General in district, J. W. Watson; Coatham Marshes, Ferguson, Nat. Hist. Redcar, 1860, p. 42; ponds, Coatham, and plentiful, brickfields pond, Coatham Marshes, C. Ashford, 'Journ. Conch.,' vol. ii, p. 236, and vol. iii, p. 279; Acklam, near Middlesbrough, abundant, B. Hudson, 1883!

22. ***Upper Derwent***—Scarborough! W. Bean, Theakston's Guide to Scarborough, 10th edition, 1877, p. 177.

23. ***Chalk Wolds***—Londesborough, Sept. 23rd, 1880, J.D.B. ; common in pond by railway, west side of Scarbro' line, near Bridlington, Aug. 1885, G. Wingate ! Ellerker, near Brough, June, 1878 ! Leckonfield Moat, Sept. 4th, 1884, W.D.R. !

24. ***Holderness***—Very abundant about Beverley ; at Figham, in a ditch, strongly impregnated with iron, J.D.B., Jour. Conch., iii, p. 177 ; also at Swinemoor and Long lane, but mostly small, the frequent cleaning of the ditches preventing its arrival at maturity, J.D.B., l. c., p. 293 ; ditch, near Wassand, Hornsea, J.D.B., l. c. p. 137 ; common about Hull, J.D.B., Nat., vol. iv., p. 71, Nov. 1878 ; common at Hornsea Mere, June 6th, 1881, W.D.R. ! New Holland near Meaux, May 29th, 1882, W.D.R. ! Dyke at Newland, Hull, 21st May, 1883 !

Var. **inflata** Moquin-Tandon.

Clessin refers the var. *inflata* of Moquin-Tandon to *Planorbis bulla* of Müller, with which name he supersedes the one it is generally known by in England.

7. ***Went Vale***—Ackworth and River Went, J. Wilcock, 12th Report Wakefield Nat. Soc., p. 27, 1883.

10. ***Colne***—Canal near Huddersfield, J. Whitwham !

Var. **curta** Jeffr.

A short-spired obese form has been characterized under this same name by Van den Broeck in the 'Ann. Soc. Mal. Belg.', iv., p. 90, pl. 2, f. 5 a. b., 1869.

Helix bullaoides Donovan, which many authors have refered to this variety, is in our opinion more correctly placed under the var. *oblonga.*

7. ***Went Vale***—Askern, H. Shaw, Jour. Conch., vol. iii., p. 286 !

Var. **oblonga** Jeffr.

Helix bullaoides Donovan !

3. ***Vale of York***—Numerous with type in a ditch near the Ouse, below York, 1886, R. Whitwell !

7. ***Went Vale***—Common in the River Went at Ackworth, J. Hebden, 'Jour. Conch.', vol. i, p. 4, 1874 !

13. ***Airedale***—Thwaite Gate, near Leeds !

20. ***Lower Tees***—Ditch, Acklam, on the trias, B. Hudson, 1883 !

Var. **albina** Jeffr.

22. ***Upper Derwent***—Mr. C. Ashford has specimens sent to him by Mr. Bean and stated to have been found at Scarborough.

Sub-genus BULINUS Adanson.
Mantle simple-edged and not reflected over the shell.

Bulinus, like *Segmentina*, is sufficiently distinct to be considered a separate genus, but in this paper we retain them both as sub-genera only.

Adanson's name dating from 1797 has priority over the names *Aplexa* and *Nauta* proposed by Fleming and Leach respectively for this group.

Physa hypnorum (L).

Local and gregarious.

Physa elongatina Lewis.
Physa glabra De Kay.
Bulinus tryoni Currier.

The two names given above are referred to this species on the authority of W. G. Binney and we refer Currier's species here after a study of the description and figures given by Tryon.

Of all our freshwater shells, *P. hypnorum* is the species most strongly displaying the habit of making, and using for the purpose of locomotion, the filaments of mucus which many of our freshwater univalves are capable of exuding for this object. The present species has been actually observed to form these glutinous threads fourteen inches or more in length.

This species is more local and gregarious than *P. fontinalis*, and is perhaps the most hardy of our freshwater species, having been found by Middendorf in Taimyrland, Siberia, in $73\frac{1}{2}°$ north latitude, but all Siberian specimens belong to Westerlund's variety *polaris*, which is identical with the variety *depressior* Middendorf, and differs from the type by its shorter and more obese form and other characters.

The most noticeable variations are in size—which varies from 6 to 21 mill—and in colour from very pale horny to an intense reddish hue, which latter is the var. *rubra* Van den Broeck. In this country it is often found living associated with *P. spirorbis* and *L. glabra*, as already noted under *P. spirorbis*.

P. hypnorum is essentially a circumpolar species and would appear to attain its greatest development in the cool temperate regions of North America, as the largest specimens we have ever seen were collected by Mr. R. M. Christy in Manitoba and measured over 21 mill. in length.

According to Jeffreys and Reeve its southern range in Europe is bounded by the Pyrenees, but Graells has recorded it for several localities in Spain.

Its British distribution is summarised by Dr. Jeffreys as from the Moray Firth district to Guernsey and so far our researches have not enabled us to extend its range further northwards.

3. ***Vale of York.***—Very abundant in the York district, and I think unusually fine. In vast numbers in a certain pond at Bishopthorpe, where I could obtain it by handfuls once, when it was dried up. One individual measured 4-5ths of an inch in length; also common in the ditches by Acomb Wood, the stream on Clifton Ings, a dirty ditch beside the public footpath to the north end of Scarborough bridge, Poppleton, Bootham, Tillmire, Strensall, Knavesmire, and elsewhere, pond near Burton Lane, Clifton (H. Richardson), R. M. Christy, Zool., p. 183, 1881; a small ditch, Huntington! in one ditch at Askham, R. M. Christy, Nat. Hist. Journ., iii., 130, Nov. 1879; Knavesmire, April, 1882! rather scarce in the Foss, H. Richardson; Wighill; Shircoaks Wood, near Tadcaster; Catterton; Healaugh; Bilbrough, &c., F. G. Binnie; Wetherby, May 21st, 1877, H.C.! ditches by roadsides east of Brafferton, abundant, Sep. 11, 1882, W.D.R.! ditch near Woodhall Bridge! pond near Church Fenton Station, 1879! ditch by railroad side, Milford Junction, April 12th, 1868! Garforth, April 17th, 1876, Nat., i. 160, May, 1876! South Milford, June, 1876, G. Roberts, Topog. and Nat. Hist. of Lofthouse, ii. 312. 1885; pond, Harlethorpe, near Bubwith! Sherburn! Rudding, F. R. Fitzgerald! pond near Grimbald Crag, Knaresborough, June, 1871! Ferrensby, near Knaresborough, April, 1884! rare in ditch, Boston Spa, first found in 1858. J. Emmet; Strensall Common, very local, but common where it is found. W. Hewett. 1884.

4. ***Humber***—Goole, Armin and Carlton, R. D. Maxwell; Swinefleet, Aug. 6th, 1887! Wressle, July 23rd, 1886, J. Beanland! Carlton, near Snaith! ditch on roadside, Ermine St., Castleford, March 22nd, 1868! ditches and ponds near Castleford, G. Roberts, Topog. and Nat. Hist. Lofthouse, ii., p. 175, 1885; Ferrybridge! Barlow, nr. Selby! pond nr. Breighton! Brotherton, Feb. 5th, 1882! Sharlston Common, Feb. 1887! Ditch near Scalm Park, May 8th, 1887! pond near Wistow and ditch near Cawood! and in ditches, Cowbridge near Newport, Sandholme, and Featherbed Lane near Cavil Wood, May, 1887!

5. ***Hatfield and Thorne***—Potteric Carr, J. Emmet; grassy puddle, by R. Torne, May 14th, 1883, W.D.R.! near Doncaster! one in rejectamenta of a small stream near Bawtry, W. Gain, 1886! Thorne Waste, May 30th, 1888 (Nat. Hist. Journ., 1888, p. 158).

6. ***Trent***—Conisborough, June 2nd, 1873, J. Wilcock, Yorkshire Nat. Recorder, p. 204, July, 1873. Anston Crags, Sept. 1885, Rev. Hilderic Friend!

7. ***Went Vale***—Ackworth, moderately common in ditches, but not everywhere, C. Ashford, Q.J.C., i, p. 20, 1874; in the last field before the East Hardwick Road from Ackworth to Went Vale; pond on the left of Hessle Common, W. E. Brown, 1880; a marshy field about midway between Ackworth and Wentbridge, W. Graveson, Nat. Hist. Journ., vii., p. 3, Feb., 1883; Askern, J.W., Nat., 1876, p. 191; Norton, G. Roberts, Topog. and Nat. Hist. Lofthouse, 1885, vol. ii, p. 237; field-pond close to Wentbridge, H. Richardson, Nat. Hist. Journ., vol. vii., p. 4, 1883; Pollington!

8. ***Dearne***—Dearne and Dove Canal, June 30th, 1884, W. E. Brady!

12. ***Lower Calder***—Common in a ditch at Stanley, more rarely at Cold Hiendley; very common at Horbury, J. Hebden, Q.J.C., vol. i, p. 4, 1874; St. Swithin's Wood and Ryhill, J. Wilcock, 12th Report Wakefield Nat. Soc., p. 27, 1883; Stanley, 1863!

13. ***Airedale***—Ditches in Leventhorpe Pastures, April 3rd, 1866! Methley, April 1865, W.H.B.; Garforth, April 17th, 1876!

14. ***Malhamdale***—Profusely abundant in a pond near Bell Busk, April, 1887, W. E. Collinge!

16. ***Nidderdale***—Ripley Lake, 1887, F. R. Fitzgerald!

17. ***Wensleydale***—Birk Rigg, in Semerdale, 1876, H. Crowther! ditches and rivulets, Ripon, Rev. J. Dalton, Mag. N. H. and Nat., 1858, p. 14;; numerous but small, associated with *Limnæa glabra* in ditch on west side of railway, near Roecliffe, May 25th, 1885, W.D.R.!

18*a*. ***Vale of Mowbray***—Vale of Mowbray, Grainge, 'Vale of Mowbray,' p. 38, 1859; 'ditch by roadside between Thirsk and Topcliffe, in considerable abundance, J. Foggitt,' J. H. Davies, Nat., p. 136, 1855.

20. ***Lower Tees***—General in district, J. W. Watson; Coatham Marshes, grassy ditch by the old railway, small but deeply coloured, C. Ashford, Journ. Conch., vol. ii., p. 236, 1879; plentiful in ditches, Kirkleatham Road, Coatham, May 1st, 1887, Baker Hudson!

22. ***Upper Derwent***—Scarborough, W. Bean, Theakston's 'Guide to Scarborough,' edition 10, p. 177, 1871! Scarborough, C. Ashford, 1885!

24. ***Holderness***—Rejectamenta of Beverley Beck, Cherry Tree Lane, Kitchen Lane, and Commonbank Nook, near Beverley, not common, J.D.B., Journ. Conch., vol. iii, p. 293; Figham, May 29th, 1882, W.D.R.! plentiful in the River Hull at Driffield, L. B. Ross, 1882! Anlaby Road and Beverley Road, Hull, J.D.B., Nat., vol. iv, p. 71, Dec., 1878; Bridlington, Rev. W. C. Hey, Journ. Conch., ii, p. 312, Oct. 1879.

Var. **major** Charp.

3. ***Vale of York***—Pond at Bishopthorpe, R. M. Christy, Zool., p. 183. May, 1888.

Monst. **decollatum** Nelson.

7. ***Went Vale***—Ditch at Hessle near Ackworth!

Genus LIMNÆA Bruguière.

As Haldeman points out, Limnæa may be separated from Physa by its dextral spire, and from Succinea by the fold upon the columella which is wanting in that genus.

Dr. Jeffreys remarks in his account of this group that they frequent shallow and still waters, but though they usually do this, some of our commonest species are found living at great depths in the Swiss lakes, and in those situations are said to respire water and not free air as is usually the case.

The anatomical relations of Limnæa are, according to Professor A. G. Weatherby, rather with Limax than with their undoubted allies, the Planorbes; and the foot gland, which is found in some Limnææ, is stated by Sarasin to be the homologue of the byssal gland of the bivalves.

This genus is found fossil in the Oolite and in subsequent deposits; in the Eocene of the Isle of Wight it occurs in

great profusion and in a variety of species. The Limnææ are world-wide in distribution, though they would seem to be more numerous in the temperate regions.

This group is especially liable to erosion, and to loss of the apex or decollation, and many causes may, according to those who have studied the subject, tend to bring about these results.

They are stated by Eisig to be proterandrous, the male organs developing usually in advance of those of the other sex.

Amongst other parasites, they are liable to be infested with *Tetracotyle typica* Dies., otherwise *T. lymnæi* Pagenstecher; but the most important parasite of this group is undoubtedly the *Distoma hepaticum*, found mostly upon *L. truncatula*, and which is the cause of rot in sheep. Several species of Gordius (*G. aquaticus* and *G. gratianopolensis*) have also been recorded as infesting this genus.

Sub-Genus AMPHIPEPLEA Nilsson.

Shell extremely thin, fragile, and glossy, with a very short spire. Mantle lobes very extensile and capable of entirely enveloping the shell.

This group is, in our opinion, sufficiently distinct to be entitled to full generic rank. We, however, refrain from carrying out this opinion here, from a desire to continue to conform to the arrangement adopted by Dr. Jeffreys.

Limnæa glutinosa Müll.

Extremely local.

This interesting species does not appear to have been found in Yorkshire since the late Mr. Bean ceased to find it at Scarborough, until its recent discovery in immense numbers in the Skidby drain, near Hull, where it was first found in October, 1889, by Mr. James F. Robinson, President of the Hull Scientific Club. Its former habitat at Scarborough is described

by Mr. J. Emmet — to whom Mr. Bean communicated the information—to be what is now the ornamental water in the Ramsdale Valley, Scarborough.

The animal has been described as of great size and very active, but these statements were not borne out by the Skidby specimens, which were very indolent and inactive, and the foot did not appear to be proportionately larger than that of the ordinary *L. peregra.* The extended portion of the mantle is unicolorous grey and very mobile, and is constantly varying in its amount of extension.

Nyst and Maltzan state that this species appears chiefly in March and April, which exactly agrees with our own observations.

Mr. G. H. Parke, F.L.S., in Hobkirk's 'Huddersfield,' hazarded the unfounded opinion that *L. glutinosa* would eventually prove to be an aberrant form of *L. peregra.*

10. ***Colne***—In Hobkirk's 'Huddersfield,' p. 224, Mr. G. H. Parke, records the finding, in 1864, of three specimens of a shell closely approaching in appearance *L. glutinosa.*

22. ***Upper Derwent***—Scarborough (W. Bean, in Theakston's 'Guide to Scarborough,' ed. x., p. 187, 1871).

24. ***Holderness***—Abundant in Skidby drain, Hull. 1889 and 1890! F. W. Fierke, Journ. of Conch., vi., 251, July, 1890.

Sub-Genus RADIX Montfort.

Shell subovate, last whorl ventricose; aperture more than half the length of the shell, greatly expanded.—Binney and Bland, 'Land and Freshwater Shells of North America,' part ii, p. 30, 1865.

Mantle not extending beyond the margin of the shell.

Leach's name Gulnaria is perhaps more generally used than the name given by Montfort, which, however, has the priority. H. and A. Adams use Klein's name, Neritostoma, but according to Mr. Binney, the figure and description given by Klein refer rather to Succinea than to Limnæa, in which sense the name is used by Herr Clessin.

Limnæa peregra Müll.

Widely distributed and very abundant.

This species, as understood in England has received a multitude of specific and varietal names, as the result of the labours of the different British and Continental conchologists who have studied it. Even by the more conservative of the foreign scientists several forms are recognized as perfectly distinct species which we in England consider varieties only. The wide range of variation of this species makes it quite necessary that some classification of its varied forms should be adopted, and we shall therefore in the present catalogue accept the varieties instituted by Dr. Jeffreys, and add such other well-marked forms as may seem to us sufficiently distinct to be noticed.

L. peregra is one of the most widely distributed species known, and has been reported from every European country, large tracts of Asia, Africa, and America, and even from Tasmania. It is found over the whole of the British Isles and is widely distributed throughout Yorkshire, being recorded from all of the twenty-five districts into which we have divided the county.

It can sustain the greatest extremes of temperature, and has been found living in water at Burnley which at times attains a temperature of 100° Fahr., as we are assured by Mr. Wigglesworth, while in the opposite direction it is found to exist in the icy waters of the greatly elevated Pyrenean lakes.

This species is found in the brackish water of the Baltic, attached to sea-weeds, &c., up to a depth of twelve fathoms; but in these situations the shells are much dwarfed, owing to the unfavourable conditions under which they exist. In the brackish-water lakes in the Landes, where it is also found, the specimens are very often deformed, owing to interruptions of the regular growth.

Dr. Brot and Herr Clessin have separated as a distinct species the *L. peregra* existing in the depths of Lake Geneva. Mr. Thompson also records a deep water form of this shell from Lough Neagh, Ireland, and more recently Rev. W. C. Hey has remarked on a similar habit in River Ouse specimens at York.

Dr. Gwyn Jeffreys regarded as synonymous with our species the *L. columella* of Say, which, under the various names of *L. chalybea* Gould, *L. acuminata*, *succiniformis*, and *columellaris* Adams, *L. strigosa*, *coarctata* and *casta* of Lea, *L. navicula* Valenciennes, and *L. macrostoma* of Say, is distributed over large tracts of North America.

The *L. goodwinii* E. A. Smith, from Japan, is considered by Mr. Nelson, after an inspection of the type specimens in the British Museum, to be identical with our species.

Several parasites have been recorded as found infesting *L. peregra* or its varieties:—Linstow describing *Cercaria pugio* and *Distoma limnææ-ovatæ*, as infesting the var. *ovata*, and also recording the finding of encapsuled embryos of *Gordius aquaticus* in the var. *vulgaris*. The larva of *Chironomus prasinus* has been found in the body of var. *ovata* by Mr. H. P. Fitzgerald.

The earliest geological formation containing *L. peregra* is the Red Crag, at Butley, in Suffolk. It has been found in Yorkshire in the peat-bed beneath the glacial drift in the Hornsea mud-cliffs, as well as in the mud-cliffs on the north bank of the River Wharfe at Carthick Ford, and in a deposit on the banks of the River Tutt, near Staveley, where it is associated with a number of other freshwater species.

It is, however, worthy of remark that the Rev. E. S. Dewick states that the Barnwell Gravel fossils of this species cannot be separated from those of undoubted *L. auricularia*.

Hazay states that he has verified by actual demonstration that the typical form of *L. peregra* is produced by living in 'hard' running water containing much carbonic acid, and that

eggs of *L. ovata*, which he placed in springs or rivulets, yielded *L. peregra*, whilst those of the typical form, placed under suitable conditions, produced the var. *ovata*.

1. ***Mersey***—Mossley, H. Crowther! Saddleworth! Lees near Oldham!

2. ***Lune and Ribble***—Plentiful in stream at Barn Gill, near Hammerton Hall, Aug. 9th, 1885, W.D.R.! near Ingleborough, Geo. Roberts, Zool., 1868, p. 1382; Chapel-le-dale Valley, April 23rd, 1886, W.D.R.! River Ribble and Scaleber Beck, April 28th, 1885, Rev. W. C. Hey, Nat., June, 1885, p. 258; common in horse-trough, Grunsagill Bridge, Aug. 10th, 1885, W.D.R.! Newton-in-Bowland, August 9th, 1885, W.D.R.! Ebbing and Flowing Well, Settle, 1878! ditch, Ingleton, September, 1878! pond by river, Gisburn, April 18th, 1881, W.D.R.! River Hodder, Bashall Eaves, August 8th, 1885, W.D.R.! stream, Smithies Bridge, near Sawley, abundant but small, August 8th, 1885, W.D.R.! Bracewell, near Skipton, common, April 18th, 1881, W.D.R.!

3. ***Vale of York***—In the greatest abundance about York, R. M. Christy, Zool., p. 183, May, 1881; Askham Bog, R. M. Christy, Nat. Hist. Jour., Nov., 1879, p. 130; ditches by the Foss above Yearsley Bridge, 1858, W. Whitwell; ditch, Huntington! Knavesmire, April, 1882! pond, Bootham Junction, April, 1882! ditch and pond, Bootham Stray, April, 1882! Naburn Lock, February, 1878, J. Grassham! Acomb, April, 1882! Steeton near York, 1880! Clifton Ings, April, 1882! Hobmoor, R. M. Christy, August, 1883; River Foss, April, 1886, O. Morland! ditches, Middlethorpe Ings, 1865, R. Whitwell; very large, Bishopthorpe, 1858, W. Whitwell; River Ouse, where it lives in quite deep water, and though very plentiful is quite dwarfed, Rev. W. C. Hey, Report Yorks. Phil. Soc. 1883, p. 35; common about Boston Spa, J. Emmet, 1882; Oxton near Tadcaster, 1888! roadside ditches, Brafferton, September 11th, 1882, W.D.R.! stream, Bolton Percy, July 13th, 1880! ditch, Thorner, May 15th, 1883, H. Pollard! water-trough near Rigton, 1876! Collingham Mill Dam, October 30th, 1879! ditch, Bardsey, April 15th, 1877! Bishop Dyke near Milford, April 12th, 1888! Hook Moor, October 6th, 1866! Seacroft, common, June 18th, 1882, B. Holgate! Asp Ponds, Knaresbro', July, 1882! Pond, Sicklinghall! Newthorpe near Sherburn, February 12th, 1882, H. Crowther! Hollin Lake near Harewood! stream, Spofforth! River Cock, Towton, March, 1884! pond, Harlethorpe near Bubwith! pond, Follifoot! water-trough, near Pompocali, April 15th, 1877! pond, Lazencroft, 1880! Barlby, common on bank of Ouse, September 6th, 1879, W.D.R.! stream, Church Fenton, Aug., 1881! Healaugh Hall, 1877, H. Crowther Strensall Common, September, 1880, W. Raine; pond, Sicklinghall, October, 1882! pond, Huddlestone, 1879! pond, Riccall, June, 1879! boggy ground, Newton Kyme, 1881! pond, near Ulleskelf,

H. Pollard! stream, Bishopwood, July 31st, 1864! Clifford, August 8th, 1871, S. Scholefield! Malton, September 23rd, 1880, J. D. Butterell! Garforth, 1881, H. Pollard!

4. ***Humber***—Stream near park, Pontefract! stream near church, Water Fryston! Selby Cut and neighbouring ditch, June, 1879! ditch, Birkin, October 17th, 1880! near Bar House, Ermine Street, Castleford! ditch, Brayton, October 17th, 1880! Ledstone! pond, Camblesforth, August, 1881! ditch and pond, Carlton Park, Snaith, W.D.R.! ditch, Burton Salmon! canal, near Burton Hall, Oct. 17th, 1880! Barlow, near Selby! South Milford, November 12th, 1882! old lime canal, Brotherton, February 5th, 1882! ditch and Stocking Drain, near Hillam! ditch near Lumby! Wressel Castle! numerous in old channel of River Ouse at Hemingbrough, 28 June, 1890! and near railway, Hagg Lane, Hemingbrough, 28 June, 1890!

5. ***Hatfield and Thorne***—Common in ditch parallel with Black Bank Drain, April 14th, 1883, W.D.R.! common in ditches, Ackholme, May 14th, 1883, W.D.R.! Kirk Sandall and Barnby Dun, July 2nd, 1886. G. Roberts! abundant in Huggin Drain and West Moor Drain, near Hatfield, Sept. 21st, 1887, W.D.R.!

6. ***Trent***—Conisborough, June 2nd, 1873. J. Wilcock! ponds, Doncaster, J. Hardy! Anston Crags, April 30th, 1885, W.D.R.! plentiful in Chesterfield Canal, near Kiveton Park Station, April 30th, 1885, W.D.R.!

7. ***Went Vale***—Common about Ackworth, C. Ashford, Zool., 1854, p. 4263; ditch, Hessle, near Ackworth, March 19, 1882! pond, near plantation, Ackworth, March, 1883, and ditch, Grosvenor Place, Ackworth, March, 1883, H. Richardson! pond at Norton, April 22, 1878! Wentbridge, G. F. Linney, 1880, J. Whitwham! river Went at Norton, April 22, 1878! and at Ladythorp, J. Whitwham! Smeaton Crags, in ditch by side of river Went! Cross Hill, near Pollington, April, 1882! Moss, near Askern, April, 1882! stream near Askern pool! Hemsworth dam, Jan. 16, 1882! (H. Richardson, Nat. Hist. Journ., 1882, vi., p. 73); common in pond and in ditches, Cowick Park and in West Cowick brick-pond, June 17, 1882, W.D.R.! Whit Hall, near Doncaster, J. Whitwham! Campsall, May 20, 1886, S. H. Bennett! Birka drain, Womersley, H. Crowther! near Sharlston Hall!

8. ***Dearne***—Dearne and Dove Canal, June 30th, 1884, W. E. Brady! Wakefield and Barnsley Canal, near Barnsley, March 29th, 1878! near Barugh Lock, A. P. Taylor! and at Royston, March 29th, 1868! common in fish pond, Cusworth Park, near Doncaster, May, 1885, T. H. Easterfield! Cawthorne, J. Whitwham! abundant in canal, Stairfoot, 1884, J. Gelder! Denby Dale!

9. ***Don***—A few in a field-drain leading into Cubley Brook, Penistone, September 1889, L. E. Adams! Common in Mill dams, Rivelin Valley, June 2nd, 1881, W.D.R.!

10. *Colne*—Liddle and Briery's Mill Dam, Marsh! Deighton Bank, J. Whitwham! Near Canal, Golcar! Paddock! Close Mill Dam, Huddersfield! Gunthwaite! Well at Dalton Bank and Newline, near Dalton, J. Whitwham! Nab Hill, Kirkheaton! Holmfirth Bridge Mill Dam, J. Whitwham! Luck Lane, Marsh! Linthwaite, J. Whitwham! Farnley Mill Dam! Milnsbridge, J. Whitwham! Canal at Golcar and at Huddersfield! Greenhead Park, J. Whitwham! Saltwick, J. Whitwham! Thirsk Clough!

11. *Upper Calder*—Canal between Elland and Brighouse! Salterhebble! Scholes, near Cleckheaton! Liversedge! stream near Low Moor Station! mill pond, Hebden Bridge, 1878, A. Taylor!

12. *Lower Calder*—Generally distributed about Wakefield (J. Wilcock, Rep. Wakefield Nat. Soc., p. 27, 1883), Ossett! Pugneys! Sandal, J. Hebden! Dirtcar! Thornhill! Thornes, G. Taylor! Canal, Altofts, April, 1884! Barnsley Canal, between Walton and Cold Hiendley, A. P. Taylor, June, 1877! near Wakefield! and near Heath! R. Calder, Mirfield, J. Whitwham! Wintersett! Cold Hiendley! stream near Stanley, October 10th, 1880! stream and Railway ditch near Frost dam! Colliery pond, Glass Houghton! Lepton, Whitley Mill dam! Birkenshaw, J. Emmet, 1882; Stocks Moor.

13. *Airedale*—Ditch near Ivy House, 1878! pond, Neville Hill, 1878! ponds, Black Hills, Feb. 28, 1864! stream, Primrose Valley, April 5, 1866! ponds, Osmondthorpe! Manston Lane! and Seacroft! common in stream and lake, Killingbeck, June 27, 1866! Halton beck and the water-trough, Halton dial, 1877! ditch near cemetery, Burmantofts! ponds near old mill, Foundry Lane, April, 1877! pond, Roundhay Grange, 1878! upper and lower lakes, Roundhay Park, July, 1878! Gipton beck! Low Coldcotes! near Bramley Grange, Thorner, 1882, H. Nelson! Leeds and Liverpool canal at Armley! Kirkstall! Newlay! Calverley! Rodley! Saltaire, June 28, 1866! river Aire at Bingley, May, 1882, W. West! rare in field ditches, Bingley, Nov. 1886, J. A. Hargreaves! Seven Arches, Bingley, July 9, 1882, W.D.R.! pond, stream and water-trough, Hawkesworth Wood, Horsforth, March 9, 1887, W.D.R.! common, Clayton Wood, Cookridge, April 1, 1883, W.D.R.! mill-pond, Rawdon! Silveroyd Hill, Wortley, C. Smethurst! pond nr. Bramley Station! stream, Thorpe on the Hill, Ardsley! pond, Bullerthorpe Lane, and canal, Swillington, Oct. 10, 1880! Brown Moor colliery, near Barrowby! 'Old Canal,' Woodlesford! pit-streams, Leventhorpe, April 3, 1866! Knostrop, April, 1884! pond and stream, Allerton Bywater, 1881! Methley Low Common, July 5, 1884! Newsam Green, April, 1884! Mill Goit, Meanwood, April 17, 1864! stream at Adel, Feb., 1871, S. Scholefield! abundant, Beckfoot reservoir, April 8, 1883, E. P. P. Butterfield! Shipley Glen, June 27, 1883, W. West! common, stream and pond, Baildon, May, 1882, W. West! plentiful, Dudley Hill, Nov. 18, 1886, F. Rhodes!

Dytiscus circumcinctus Ahr. About twenty years ago, when I was with Archdeacon Hey at Askham Bog, we took a single specimen of this insect, the only one, I believe, ever taken in Yorkshire. It was obtained when using the net in deep water (wading up to the thighs). The specimen belongs to the anomalous form characteristic of this species—a smooth-backed female.

4. CENTRAL.—Askham Bog, one example (*W. Hey*).

Dytiscus punctulatus F. Generally distributed but rather scarce.

2. N.E.—Marton, 1829, 'not of very frequent occurrence' (*L. Rudd, Steph. Ill.*, June 15th, 1829, ii, 195); Scarborough (*R.L.*).

4. CENTRAL.—York (*W. C. H.*); Askham Bog (*H. Hutchinson*).

5. S.W.—Wakefield district (*E.B. W.*).

Dytiscus dimidiatus Berg. Only found in Yorkshire at Askham Bog, where it was taken in 1830, and where I took a single specimen (a female) in 1882—the last recorded capture of this noble insect in Britain.

4. CENTRAL.—Askham Bog, 1830 (*A. Wright, Loudon's Mag.*, 1831, iv. 165); ditto, a single example, March 11th, 1882 (*W.C.H.*).

Acilius sulcatus L. Common and general.

1. S. E.—Brough (*E.B. W.*); Flamborough (*W.C.H.*).

2. N.E.—Scarborough (*R.L.*); Coatham (*W.C.H.*).

3. N.W.—Studley (*E.A. W.*).

4. CENTRAL.—York (*W.C.H.*); Askham Bog (*W.D.R.*); Wetherby (*H. Crowther*).

5. S.W.—Wakefield (*E. B. W.*); Hebden Bridge (*S. Gibson*).

Hydaticus transversalis Berg. Confined to Askham Bog, and now very scarce. The last pair I took there were captured in a deep pond on May 13th, 1885.

4. CENTRAL.—Askham Bog, 1830 (*A. Wright in Loudon's Mag.*, 1831, iv, 165); ditto, 'in plenty' (*H. Hutchinson, E. M. M.*, June 1872, ix, 12); ditto, 1881 (Sept.), and 1885 (May) (*W.C.H.*).

Hydaticus seminiger DeG. (=*hybneri* F.). Recorded formerly from Askham Bog, but never found there during the last fifty years.

4. CENTRAL.—Askham Bog, 1830 (*A. Wright, Loudon's Mag.*, 1831, iv, 165).

GYRINIDÆ.

Gyrinus minutus F. Local.

1. N.E.—Marton (*L. Rudd, Steph. Ill.*, June 15th, 1829, ii, 195).

4. CENTRAL.—Buttercrambe Moor (*W. Hey*).

Gyrinus natator Scop. Very common and general in ponds and ditches, and conspicuous from its dazzling 'gyrations.'

1. S.E.—Bridlington (*W.C.H.*).

2. N.E.—Scarborough (*R.L.*); Redcar (*W.C.H.*).

3. N.W.—Studley (*E.A.W.*).

4. CENTRAL.—York (*W.C.H.*); Riccall and Pannal (*W.D.R.*).

5. S.W.—Hebden Bridge (*S. Gibson*); Leeds (*W. H. Taylor*); Wakefield (*E.B.W.*).

Gyrinus marinus Gyll. Locally abundant.

1. S.E.—Bridlington Quay (*W.C.H.*).

4. CENTRAL.—Askham Bog, March, 1882 (*W.C.H.*).

NOTE.—In the *Zoologist* for 1846, iv, 1238, this species is vaguely stated to occur 'in the Ouse' (*T.J. Bold*), in all probability the Newcastle stream called 'Ouse Burn.'

Gyrinus opacus Sahl. Perhaps only a variety of the last-named species. It has only once been taken in Yorkshire.

1. S.E.—Beverley, June, 1882 (*W.C.H.*).

NOTE.—Some records of the capture of *Gyrinus bicolor* Payk. (*Nat.*, Dec., 1878, iv, 74, and *Nat.*, Sept., 1879, v,

21), can scarcely be accepted. Possibly they belong to *G. elongatus* Aubé. There is a good deal of confusion in this genus.

Orectochilus villosus Müll. Local.

2. N.E.—Scarborough (*R.L.*).

3. N.W.—Studley (*E.A. W.*).

5. S.W.—Hebden Bridge, 1831 (*S. Gibson*).

HYDROPHILIDÆ.

HYDROPHILINA.

Hydrocharis caraboides L. This insect has only been taken in one locality in Yorkshire, and there is no record of its capture there for more than half a century.

4. CENTRAL.—Askham Bog, 1830 (*A. Wright, Loudon's Mag.* for 1831, iv, 165). A pair were also taken there by Robt. Cook of York, about the same time.

NOTE.—There is a note in the *Naturalist* for August, 1872, which describes *Hydrophilus piceus* as a Yorkshire insect. I have, however, come to the conclusion that it is safest not to include that insect in this list, as it is not known by whom it was named, and as the locality given (Huddersfield) is such an improbable one for a beetle with fen proclivities and a South-Eastern distribution. Mr. Hobkirk himself advises this course.

HYDROBIINA.

Hydrobius fuscipes L. One of the commonest of our water beetles, found in ponds and puddles everywhere.

1. S.E.—Bridlington (*W.C.H.*); Brough (*E.B. W.*).

2. N.E.—Thornton-le-dale, Scarborough (*W.C.H.*); Whitby (*E.B. W.*).

4. CENTRAL.—York district, everywhere (*W.C.H.*).

5. S.W.—Wakefield district (*E.B. W.*); Hebden Bridge (*S. Gibson*).

Var. **picicornis** Sharp.

4. CENTRAL.—Askham Bog (*W. W. Fowler*).

Philhydrus testaceus F. Only recorded from one locality, but there very abundant.

4. CENTRAL.—Askham Bog (*W.C.H.*).

Philhydrus nigricans Zett.

4. CENTRAL.—Askham Bog (*W. C. H., etc.*).

5. S.W.—Hebden Bridge, 1831 (*S. Gibson, Loudon's Mag.*, 1832, v, 555).

Philhydrus melanocephalus Ol.

4. CENTRAL.—Askham Bog (*W. Hey*).

5. S.W.—Hebden Bridge, 1831 (*S. Gibson*).

Philhydrus coarctatus Gredl.

4. CENTRAL.—Askham Bog (*W.C.H.*).

Cymbiodyta ovalis Thoms.

1. S.E.—Kingston-upon-Hull (*Steph. Ill.*, Feb. 1, 1829, ii, 131).

4. CENTRAL.—Askham Bog, abundant (*W.C.H.*)

Enochrus bicolor Gyll.

2. N.E.—Scarborough (*R. Lawson*).

Anacæna globulus Payk. Doubtless common and general, but overlooked.

2. N.E.—Scarborough (*R.L.*).

4. CENTRAL.—York district (*W.C.H.*).

Helochares lividus Forst. In Yorkshire this species has only been found at Askham Bog—its northern limit in this country.

4. CENTRAL.—Askham Bog (*W. Hey*, etc.).

Laccobius sinuatus Mots. The species of *Laccobius* have been too much confused to make it worth while quoting any records which have not been verified.

4. CENTRAL.—Askham Bog (*W.C.H.*).

Laccobius bipunctatus F.

4. CENTRAL.—Askham Bog (*W.C.H.*).

Berosus spinosus Stev.

2. N.E.—Scarborough (*R. Lawson*).

Berosus signaticollis Charp.

4. CENTRAL.—Askham Bog (*H. Hutchinson*).

Limnebius truncatellus Thoms. Common and general, but very liable to be overlooked.

1. S.E.—Brough (*E.B.W.*).

4. CENTRAL.—York district (*W.C.H.*).

5. S.W.—Wakefield (*E.B.W.*); Hebden Bridge (*S. Gibson*).

Limnebius nitidus Marsh.

2. N.E.—Scarborough (*R. Lawson*).

Limnebius picinus Marsh. This rare and tiny insect is often very abundant at Askham Bog.

4. CENTRAL.—Askham Bog (*W.C.H.*); Stamford Bridge (*W. W. Fowler*).

Chætarthria seminulum Herbst.

4. CENTRAL.—Askham Bog (*W.C.H.*).

NOTE.—It is stated in *Steph. Ill.*, Jan. 1, 1829, ii, 125 that *Spercheus emarginatus* Schall., had been taken near York. I do not myself place much confidence in the record.

HELOPHORINA.

Helophorus tuberculatus Gyll. The synonymy of this genus is in a state of hopeless confusion, and the species are not well distinguished. The present species is a well-defined one, and one of the great 'finds' of the Scarborough collectors.

2. N.E.—Scarborough (*R. Lawson*).

Helophorus nubilus F.

1. S.E.—Bridlington Sands (*W.C.H.*); Market Weighton (*W.C.H.*).

3. N.W.—Hebden Bridge, 1831 (*S. Gibson*).

Helophorus aquaticus L. This insect swarms in all ponds and puddles.

1. S.E.—Bridlington (*W.C.H.*).

2. N.E.—Scarborough, Redcar, &c. (*W.C.H.*).

4. CENTRAL.—York district (*W. C. H.*); Wetherby (*H. Crowther*).

5. S.W.—Wakefield district (*E.B. W.*); Hebden Bridge (*S. Gibson*).

Helophorus dorsalis Marsh.

2. N.E.—Marton Lodge, uncommon (*L. Rudd, Steph., Ill.*, June 15th, 1829, ii, 196).

Helophorus æneipennis Thoms.

4. CENTRAL.—Ouse refuse at York, very abundant (*W.C.H.*).

Helophorus brevipalpis Bedel. Common and general.

1. S.E.—Bridlington (*W.C.H.*).

2. N.E.—Redcar (*W.C.H.*).

3. N.W.—Knaresborough (*W.C.H.*).

5. S.W.—Wakefield district (*E.B. W.*); Hebden Bridge (*S. Gibson*).

4. CENTRAL.—York district (*W.C.H.*).

HYDROCHINA.

Hydrochus elongatus Schall.

2. N.E.—Scarborough (*R. Lawson*).

Henicocerus exsculptus Germ.

5. S.W.—Halifax (*Fowler, Brit. Col.*, p. 243).

Ochthebius marinus Payk.

1. S.E.—Pools of salt water on the banks of the Humber (*W. Spence, Steph. Ill.*, Jan. 1st, 1829, ii, 114).

Ochthebius pygmæus F.

4. CENTRAL.—Askham Bog (*W.C.H.*); Selby (*W.C.H.*).

5. S.W.—Hebden Bridge watercourse, 1831 (*S. Gibson*).

Ochthebius rufimarginatus Steph.

2. N.E.—Scarborough (*R. Lawson*).

Hydræna testacea Curt.

4. CENTRAL.—York (*W. Hey*).

5. S.W.—Halifax (*Steph. Man.*, 1839, page 87; also see

Zool., 1856, xiv, 5053). Hebden Bridge watercourse, 1831 (*S. Gibson*).

Hydræna palustris Er. One of the York rarities found by the late Archdeacon Hey.

4. CENTRAL.—Askham Bog (*W. Hey*); see *Entom. Annual* for 1867 and *Ent. Trans.*, Nov. 19th, 1866, 3rd Series, v, 443.

Hydræna riparia Kug.

2. N.E.—Scarborough (*R. Lawson*).

4. CENTRAL.—York (*W. Hey*).

5. S.W.—Halifax, 1830 (*Curtis, B. Ent.*, vii, 307); Hebden Bridge (*Steph. Ill.*, March 31st, 1835, v, 399).

Hydræna gracilis Germ.

2. N. E.—Scarborough (*R. Lawson*).

4. CENTRAL.—Askham Bog (*W. Hey*; see *Zool.*, 1856, xiv, 5053).

Hydræna atricapilla Wat.

2. N.E.—Scalby (*R. Lawson*).

5. S.W.—Hebden Bridge (*S. Gibson, Steph. Ill.*, March 31st, 1835, v, 393; but see *Zool.*, 1856, xiv, 5053).

Hydræna pygmæa Wat.

2. N.E.—Scarborough (*R. Lawson*).

Hydræna pulchella Germ.

2. N.E.—Scalby Beck (*R. Lawson*).

5. S.W.—Hebden Bridge watercourse, 1831 (*S. Gibson*). This record is of doubtful value; also recorded from 'the Yorkshire Moors' (*Ent. Trans.*, 19th November, 1866, 3rd Series, v, 443).

SPHÆRIDIIDÆ.

Cyclonotum orbiculare F.

2. N.E.—Gormire (*W.C.H.*).

4. CENTRAL.—Askham Bog (*W.C.H.*, etc.).

Sphæridium scarabæoides F. Very abundant in dung

everywhere. Sometimes large flights of it appear on footpaths.

1. S.E.—Market Weighton (*W. C. H.*); Bridlington (*W.C.H.*).

2. N.E.—Scarborough, Gormire (*W.C.H.*).

3. N.W.—Ilkley, Leyburn (*W.C.H.*); Pannal (*W.D.R.*).

4. CENTRAL.—York district, everywhere (*W. C. H.*); Wetherby (*H. Crowther*).

5. S.W.—Wakefield district (*E.B. W.*).

Sphæridium bipustulatum Fab. Much less common than the preceding species, but in August, 1888, I found it in profusion in a manure heap at the back of the Elephant and Castle Hotel, Knaresborough.

2. N.E.—Redcar (*W.C H.*).

3. N.W.—Knaresborough (*W.C.H.*).

4. CENTRAL.—Haxby (*W.C.H.*).

5. S.W.—Wakefield (*E.B. W.*).

Cercyon littoralis Gyll. Many genera of the *Philhydrida* have been neglected by entomologists, but none more than *Cercyon*. It is an unattractive genus to study, because the species are very ill-defined, and almost all that is known about their distribution in Yorkshire is due to my work this year (1888). The present species is entirely confined to the coast, haunting sea-weed, &c., near high water mark.

1. S.E.—Bridlington Quay (*W.C.H.*); Speeton, in dead gull (*W.C.H.*).

2. N.E.—Hayburn Wyke (*W.C.H.*); Redcar to Teesmouth in abundance, Sept. 1888 (*W.C.H.*).

Cercyon hæmorrhoidalis Herbst. This species swarms in fresh dung.

1. S.E.—Market Weighton (*W.C.H.*).

2. N.E.—Scarborough, Gormire (*W.C.H.*).

3. N.W.—Ilkley, Leyburn, Knaresborough (*W.C.H.*).

4. CENTRAL.—York, Strensall (*W.C.H.*).

5. S.W.—Wakefield (*E.B. W.*).

Cercyon aquaticus Muls.

3. N.W.—Ilkley (*W.C.H.*).

Cercyon flavipes F. A common species.

2. N.E.—Scarborough (*W.C.H.*).
3. N.W.—Ilkley (*W.C.H.*).
4. CENTRAL.—York (*W.C.H.*).

Cercyon lateralis Marsh.

2. N.E.—Hayburn Wyke, September 1888 (*W.C.H.*).

Cercyon melanocephalus L. A very common species.

1. S.E. — Market Weighton (*W.C.H.*); Hornsea (*E.B.W.*).
2. N.E.—Scarborough (*W.C.H.*).
3. N.W.—Ilkley, Knaresborough (*W.C.H.*).
4. CENTRAL.—York (*W.C.H.*).
5. S.W.—Wakefield (*E.B.W.*).

Cercyon unipunctatus L. Often very abundant.

2. N.E.—Redcar, a variety without the spot (*W.C.H.*).
3. N.W.—Knaresborough (*W.C.H.*).
4. CENTRAL.—York, very common (*W.C.H.*).

Cercyon quisquilius L. Abounds in dung.

2. N.E.—Redcar (*W.C.H.*).
3. N.W.—Ilkley, Knaresborough (*W.C.H.*).
4. CENTRAL.—York (*W.C.H.*).

Cercyon pygmæus Ill. No doubt commoner than appears.

4. CENTRAL.—York, in decayed grass (*W.C.H.*).

Cercyon analis Payk.

2. N.E.—Scarborough (*W.C.H.*).
4. CENTRAL.—York (*W.C.H.*).

Cercyon minutus Muls.

2. N.E.—Scarborough (*W.C.H.*).

Megasternum boletophagum Marsh.

4. CENTRAL.—York (*W.C.H.*).

Cryptopleurum atomarium Muls.

2. N.E.—Eston (*W. Hey*); Hayburn Wyke (*W.C.H.*).
4. CENTRAL.—York (*W.C.H.*).

STAPHYLINIDÆ.

ALEOCHARINA.

Aleochara ruficornis Grav. Scarce and local.

2. N.E.—Scarborough (*R. Lawson*).

3. N.W.—Studley, by sweeping under fir trees, and in moss by a hill-side stream (*E. A. Waterhouse, E. M. M.*, July 1871, viii, 38). Also taken at Studley by Earl de Grey and Ripon (vide *E.M.M.*, Jan. 1868, iv, 187).

Aleochara fuscipes F. By no means a common insect in Yorkshire.

2. N.E.—Scarborough (*R. Lawson*); Redcar, under decayed fish, August, 1888 (*W.C.H.*).

Aleochara lanuginosa Grav. Common in dung, etc.

1. S.E.—Bridlington (*W.C.H.*).

2. N.E.—Redcar (*W.C.H.*).

4. CENTRAL.—York (*W.C.H.*).

5. S.W.—Wakefield (*E. B. Wrigglesworth*).

Aleochara nitida Grav.

2. N.E.—Scarborough (*R. Lawson*); Redcar (*W.C.H.*).

4. CENTRAL.—York (*W.C.H.*).

Var. **bilineata** Gyll.

2. N.E.—Redcar (*W.C.H.*).

Aleochara morion Grav. Probably common, but the small species of this genus are very difficult to discriminate.

2. N.E.—Redcar (*W.C.H.*).

Aleochara procera Er.

2. N.E.—Scalby Beck (*R. Lawson*).

Aleochara algarum Fauv.

2. N.E.—Scalby Beck (*W. Hey*).

Microglossa pulla Gyll.

2. N.E.—Scarborough (*R. Lawson*).

3. N.W.—Studley, by sweeping under fir trees (*E. A. Waterhouse*, June 14, 1871, *E. M. M.*, viii, 38).

Oxypoda spectabilis Mærk.

2. N.E.—Scarborough (*R. Lawson*).

Oxypoda lividipennis Mann.

3. N.W.—Richmond (*W.C.H.*).

Oxypoda opaca Grav.

4. CENTRAL.—York (*W.C.H.*).

Oxypoda alternans Grav.

2. N.E.—Scarborough (*R. Lawson*).

Oxypoda formiceticola Mærk.

2. N.E.—Scarborough, in nest of *Formica rufa* (*T. Wilkinson, E. M. M.*, ii, 14).

Oxypoda hæmorrhoa Mann.

2. N.E.—Scarborough, in nests of *Formica rufa*, April, 1865 (*T. Wilkinson, E. M. M.*, ii, 14.)

Oxypoda annularis Sahlb.

2. N.E.—Scarborough (*R. Lawson*).

Thiasophila angulata Er.

2. N.E.—Scarborough, 1865, in nests of *Formica rufa* (*T. Wilkinson, E. M. M.*, ii, 14).

Ocalea castanea Er.

2. N.E.—Scalby, flood-refuse (*R. Lawson*).

Ocalea latipennis Sharp.

2. N.E.—Scarborough (*W. Hey*).

Ilyobates nigricollis Payk.

2. N.E.—Scarborough (*T. Wilkinson*).

Chilopora longitarsis Er.

1. S.E.—'Near Hull, by Mr. Spence, Kirby MS.,' 1832 (*Steph. Ill.*, April 30th, 1832, v, 110).

Chilopora rubicunda Er.

2. N.E.—Scarborough (*R. Lawson*).

MYRMEDONIINA.

Dinarda maerkeli Kies. Found in nests of *Formica rufa.*

2. N.E.—Scarborough (*T. Wilkinson, E. M. M.*, June, 1865).

Myrmedonia humeralis Grav. In nests of *Formica rufa.*

2. N.E.—Scarborough (*R. Lawson*).

Astilbus canaliculatus F. An abundant species.

1. S.E.—Bridlington Quay (*W.C.H.*).

4. CENTRAL.—York district, abundant. Sometimes occurs in thousands in the flood-refuse of the Ouse (*W.C.H.*); also at Selby (*W.C.H.*).

Callicerus obscurus Grav.

2. N.E.—Scarborough (*R. Lawson*); Stockton-on-Tees (*G. T. Rudd*; vide *Steph. Ill.*, April 30th, 1835, v, 434).

Thiamaræa hospita Mærk. Occurs in burrows of *Cossus ligniperda*.

2. N.E.—Scarborough (*R. Lawson*).

Notothecta flavipes Grav. In nests of *Formica rufa*.

2. N.E.—Scarborough (*R. Lawson*); also recorded by T. Wilkinson in *E. M. M.* for June, 1865, ii, 14.

Notothecta anceps Er. Also in nests of *Formica rufa*.

2. N.E.—Scarborough (*T. Wilkinson*, *E. M. M.*, ii, 14).

Homalota gregaria Er. No doubt great additions could readily be made to the Yorkshire list of *Homalotæ* by any one who gave this large and difficult genus special attention.

1. S.E.—Bridlington Quay (*W. Hey*).

Homalota elongatula Grav.

1. S.E.—Hornsea Mere, July, 1859 (*W. K. Bissill*).

3. N.W.—Studley, 1879 (*E. A. Waterhouse*).

Homalota vestita Grav.

2. N.E.—Eston (*W. Hey*).

Homalota pagana Er.

3. N.W.—Studley, 1879 (*E. A. Waterhouse*).

Homalota graminicola Gyll.

1. S.E.—Hornsea Mere, July 1859 (*W. K. Bissill*).

Homalota excellens Kr.

3. N.W.—Studley, 1867 (*E.A.W.*, *E. M. M.*, March, 1868, iv, 231).

Homalota debilis Er.

2. N.E.—Scarborough (*R. Lawson*).

Homalota circellaris Grav.

4. CENTRAL.—York district (*W. C. Hey*).

Homalota elegantula Bris.

3. N.W.—Studley, by sweeping under fir trees (*E. A. Waterhouse*).

Homalota cuspidata Er.

2. N.E.—Scarborough (*R. Lawson*).

Homalota analis Grav.

'Yorkshire,' 1839 (*Steph. Manual*, 1839, p. 359).

Homalota exilis Er.

2. N.E.—Scarborough (*R. Lawson*).

3. N.W.—Studley, banks of the Skell (*E. A. Waterhouse*, June 14th, 1871 ; *E. M. M.*, July, 1871, viii, 38.

Homalota validiuscula Kr.

3. N.W.—Studley, taken in quantities in fungi (*E. A. Waterhouse*, MS., 1879).

Homalota parallela Mannh.

2. N.E.—Scarborough, in nests of *Formica rufa* (*T. Wilkinson*, *E. M. M.*, June 1865, ii, 14).

Homalota hepatica Er.

3. N.W.—Studley, under stones and among dead leaves, 1867, and by sweeping under fir trees, 1871 (*E. A. Waterhouse*, *E. M. M.*, Jan. 1868, and July 1871).

Homalota inquinula Er. Said to be found in Yorkshire in *Steph. Ill.*, April 30, 1832, v, 128.

Homalota sordida Er.

2. N.E.—Redcar (*W.C.H.*).

4. CENTRAL.—York (*W.C.H.*).

Gnypeta cærulea Sahlb.

2. N.E.—Scalby, July (*W. Hey*).

Tachyusa constricta Er.

2. N.E.—Yarm, 1839 (*Stephens' Manual*, 1839, p. 357).

3. N.W.—Studley (*E. A. Waterhouse*, MS.).

Tachyusa flavitarsis Sahl.

2. N.E.—Scarborough (*R. Lawson*).

4. CENTRAL.—Selby, river bank (*W.C.H.*).

Tachyusa atra Grav.

2. N.E.—Scarborough (*R. Lawson*).

Myrmecopora sulcata Kies.

2. N.E.—Scarborough (*T. Wilkinson*).

Falagria sulcata Payk.

2. N.E.—Scarborough (*R. Lawson*).

Falagria obscura Gr.

4. CENTRAL.—York district, in haystack-refuse and under stones; also in the Ouse flood-rejectamenta in myriads (*W.C.H.*).

BOLITOCHARINA.

Autalia impressa Ol.

2. N.E.—Scarborough (*R. Lawson*).

3. N.W.—Harrogate (*W. Hey*).

Autalia rivularis Grav.

2. N.E.—Scarborough (*R. Lawson*).

Encephalus complicans Westw.

2. N.E.—Scarborough (*R. Lawson*); Marton Lodge (*Rev. G. T. Rudd*).

Gyrophæna gentilis Er.

2. N.E.—Scarborough (*R. Lawson*).

Gyrophæna lucdula Er.

2. N.E.—Scarborough (*R. Lawson*).

Gyrophæna strictula Er. A single specimen of this insect was identified by Mr. E. C. Rye among some coleoptera sent to him from Scarborough (vide *E.M.M.*, April, 1868, iv. 259).

2. N.E.—Scarborough (*T. Wilkinson*).

Agaricochara lævicollis Kraatz. Obtained abundantly in the Scarborough district by beating old trees.

2. N.E.—Scarborough (*R. Lawson*).

Epipeda plana Gyll. This insect has been reported from Croft, 'under the bark of a decaying elm,' by the Rev.

G. T. Rudd (vide *Curtis, B. Ent.*, 1834, xi, 514; also *Stephens, Ill.*, March 31, 1835, v, 430 and *Steph. Manual*, 1839, p. 357).

Bolitochara lucida Grav.

2. N.E.—Scarborough (*R. Lawson*).

Bolitochara lunulata Pk. In *Stephens' Manual*, 1839, p. 357, Yorkshire is given as a locality for this insect.

Bolitochara obliqua Er.

3. N.W.—Studley (*E. A. Waterhouse*, Jan. 1868).

Hygronoma dimidiata Gr.

4. CENTRAL—Askham Bog (*Rev. J. Preston*); taken in tufts of grass (vide *Curtis, B. Ent.*, 1834, xi. 514).

OLIGOTINA.

Oligota inflata Mann.

2. N.E.—Scarborough (*R. Lawson*).

Oligota pusillima Gr.

2. N.E.—Scarborough (*R. Lawson*).

Myllæna elongata Mat.

2. N.E.—Scarborough (*R. Lawson*).

Myllæna kraatzii Sharp.

2. N.E.—Scarborough (*R. Lawson*).

Myllæna brevicornis Mat.

4. CENTRAL—Askham (*W.C.H.*).

Myllæna græca Kr. Two specimens only of this insect have been found in Britain. They were taken by Mr. T. Wilkinson at Scarborough, 'probably,' says Fowler, 'on the sea-coast, as particles of sea-sand were still adhering to them.'

2. N.E.—Scarborough (*T. Wilkinson*).

Gymnusa brevicollis Payk.

2. N.E.—Scarborough (*R. Lawson*).

4. CENTRAL—Askham Bog (*W. Hey*).

Gymnusa variegata Kies.

2. N.E. — Ringing Keld, north of Scarborough (*R. Lawson*).

TACHYPORINA.

Hypocyptus longicornis Payk.

4. CENTRAL—York district (*W. Hey*).

Conosoma littoreum L.

1. S.E.—Hornsea Mere (*W. K. Bissil, Zool.*, 1859).

Conosoma pubescens Grav. Common in haystack-refuse and hedge-cleanings.

2. N.E.—Hayburn Wyke (*W.C.H.*).
3. N.W.—Near Barnard Castle (*W.C.H.*).
4. CENTRAL—York district (*W.C.H.*).
5. S.W.—Wakefield district (*E. B. Wrigglesworth*).

Conosoma lividum Er.

3. N.W.—Leyburn (*W.C.H.*).
4. CENTRAL—Strensall Common, in tussocks (*W.C.H.*); Clifton (*W.C.H.*).
5. S.W.—Leeds (*W. D. R.*).

Tachyporus obtusus L. Common and general.

1. S.E.—Bridlington (*W.C.H.*).
3. N.W.—Richmond; Leyburn (*W.C.H.*).
4. CENTRAL—York, Selby, etc. (*W.C.H.*).
5. S.W.—Leeds (*W.D.R.*); Wakefield (*E.B.W.*).

Tachyporus chrysomelinus L. Another abundant species.

1. S.E.—Hornsea Mere (*W. K. Bissil, Zool.*, 1859).
2. N.E.—Scarborough (*R. Lawson*).
3. N.W.—Ilkley; Leyburn (*W.C.H.*).
4. CENTRAL.—York district (*W.C.H.*).

Tachyporus hypnorum F. Very common and general.

1. S.E.—Bridlington Quay; Market Weighton (*W.C.H.*).
2. N.E.—Scarborough; Whitby; Redcar (*W.C.H.*).
3. N.W.—Richmond; Leyburn (*W.C.H.*).
4. CENTRAL.—York; Selby, &c. (*W.C.H.*).
5. S.W.—Wakefield (*E. B. Wrigglesworth*).

Tachyporus pusillus Gr.

1. S.E.—Hornsea Mere (*W. K. Bissil, Zool.*, 1859).
2. N.E.—Scarborough (*R. Lawson*).

FIRST SUPPLEMENT TO THE FLORA OF DEWSBURY AND NEIGHBOURHOOD.

P. FOX LEE.

FIRST SUPPLEMENT TO THE FLORA OF DEWSBURY AND NEIGHBOURHOOD.

P. FOX LEE,

Secretary for Phanerogamia
to the Botanical Section of the Yorkshire Naturalists' Union,
President of the Dewsbury Naturalists' Society,
Member of the Botanical Record Club, etc.

When the observations enumerated in the 'Flora of Dewsbury' first appeared, they were completed (excepting those by W. Rushforth, inadvertently omitted) to the end of 1886, the writer never suspecting he would be able to make so many additions during the following year.

Diligent searching, however, in nooks and corners not investigated before, and perhaps a closer scrutiny of old ground at different periods of the year, coupled with several more records by other observers (and a number mostly of old date for localities embraced in the Dewsbury district, taken from 'The Flora of West Yorkshire' by Mr. F. Arnold Lees, pub. 1888) have, it will be seen, considerably augmented the first list.

Some additional plant-localities in the district have also been noted, the following named being for the rarer species only :—

177. **Polygala vulgaris.** Meadow bank, Birkenshaw (1888), with white flowers and the true plant.

411. **Prunus cerasus.** 'Battye-ford, near Mirfield ; H. F. Parsons,' vide 'The Flora of West Yorkshire,' p. 205.

455. **Rubus radula.** Rocky hill-side, with *Ulex gallii*, Thornhill Edge.

886. **Lactuca muralis.** A fair number of plants on an old wall near Whitley Church.

1265. **Humulus lupulus.** The *female* hop-bearing plant, rarer in Yorkshire than the male. Hedgerow, Horbury (W. Rushforth).

1366. **Habenaria viridis.** Meadow bank, Birkenshaw (J. A. E. Stuart, 1888).

1455. **Typha latifolia.** Calder Grove, Horbury (W. Rushforth).

1511 *not* 1510. **Zannichellia palustris,** sub-sp. **brachystemon** Gay. Skating-pond, Thornhill Lees.

1539. **Scirpus sylvaticus.** Marshy ground, Hartley Bank, Horbury.

1596. **Carex pilulifera.** Stocks Moor.

1857. **Nitella opaca.** Hartley Bank, Horbury (W. Rushforth). Ditch, Howley.

The locality

for 682. **Adoxa moschatellina** must be changed to 'Bank Wood, Elmley Woodhouse' (W. Rushforth),

and for 1809. **Botrychium lunaria** to 'pasture, Lower Denby, near Denby Grange' (W. Rushforth) as the places named were by an oversight stated inaccurately.

To 253. **Claytonia alsinoides** add 'garden stray?';

to 1219. **Polygonum fagopyrum** add 'an escape from cultivation'; and

to 626. **Apium inundatum,** add the following remarks from the Bot. Rec. Club Report, for the years 1884-5-6.—'In the inky dye-fouled water of the canal at Dewsbury, seen only because plants were exposed on low mud bank; P. F. Lee.'

The specific name *vermiculatus* of 406½ is now found to be wrong and must be changed to *subvillosus* (*Scorpiurus subvillosus* DC.), an alien.

As additional information to the first locality given

for 785. **Senecio erucifolius,** the following remarks by Mr. F. A. Lees in the Bot. Rec. Club Rep. 1884-5-6, p.

129, may be found interesting :—'*Senecio erucifolius* L., off type in direction of *S. jacobæa*, growing in large clumps (from its strong, creeping roots), with leaves green and slightly hairy, but no cottony felting, in several spots in a long narrow plantation (on coal measure shales), half-mile from Howley Hall, over towards Woodkirk.' (Same place I gave as 'plantation, Soothill"). 'In W. Yorkshire it is rare off the dry soils over the belts of Permian lime, Triassic sand, and scar limestone.' Also see 'The Flora of W. Yorks.', p. 790. I had often noticed these fine clumps of the Downy Rag-wort, deeming it type species. One day in August, 1887, during a heavy thunderstorm I piloted Mr. Lees to the habitat.

1725B. **Festuca duriuscula** is misnamed and must be changed

to 1728, **Festuca fallax** Th., and

1750B. **Agropyron repens** var. **barbata,** is corrected

to 1751C, the sub-sp. **Agropyron pungens** var. **pycnanthum** G. & G.

---

16. **Ranunculus drouetii** Godr. Drouet's Ranunculus. 'Bulrush' mill-dam, Batley.

18. **R. peltatus** Schrank (form). Ditch, Howley, near Batley. I submitted this, labelled *elongatus* (140 Lond. Cat. 7th ed.), to Mr. F. Arnold Lees for the Bot. Rec. Club, who stated that it was 'only a form of *peltatus* not quite typical, but not really *elongatus*.'

46. **Actæa spicata** L. Herb Christopher. Been long known at Liley Wood, Upper Whitley. 'Perhaps introduced?' (vide 'The Flora of West Yorks.,' p. 127).

48. **Berberis vulgaris** L. Barberry. Hedge-bank, Horbury (W. Rushforth). Not wild there.

53. **Papaver somniferum** L. Opium Poppy. Corn-field which had been under flood in the spring, Thornhill

Lees; sporadic. With this I also gathered *Beta maritima*, *Eschscholtzia californica*, *Gilia capitata* (on bank of R. Calder, Horbury, as well), and a species of *Compositæ*—name uncertain. On submitting them to Mr. J. G. Baker, F.R.S., Kew, he said 'these weeds are all Californian, introduced no doubt with wheat.'

77. **Nasturtium sylvestre** Br. Yellow Cress. Canal-banks, Thornhill Lees.

84. **Barbarea præcox** Br. American Cress. Rail-bank by Thornhill Junction Station. A garden escape (F. A. Lees).

149. **Teesdalia nudicaulis** Br. Near Mirfield; H. Baines . . . . 'Sought here in vain, 1870.' Probably extinct there now. Vide 'The Flora of West Yorks.,' p. 148.

179. **Polygala depressa** Wend. (sub-sp.). All the Milkwort in this district has hitherto been put down as *P. vulgaris*. During a walk we had together here, in search of more *Rubus podophyllus* in August, 1887, my attention was drawn to the matter by Mr. F. A. Lees, the Recorder for the Botanical Record Club, and on the examination of a series of local gatherings, it was found that our form must be changed to *P. depressa*, the one usually occurring on heaths. It only grows on dry meadow banks in the higher parts of this district, and in all specimens examined, the plants have the flexuous stems, spathulate lower leaves and short bracts, characteristic of *depressa*. The type, *P. vulgaris*, with ascending stems, straight branches, narrow leaves and longer bracts, seems to occur farther down the Calder Valley, about Wakefield. In 1888 I gathered true *P. vulgaris*, with white flowers, at Birkenshaw, therefore No. 177 will remain in my Flora with the changed locality.

196A. **Silene gallica** sub-sp. **anglica** L. English Catch-fly. Spen Vale Mills, Heckmondwike, 1887. A wool-waste alien, here (F. A. Lees).

222. **Stellaria nemorum** L. Wood Stitchwort. 'Kirklees Woods; Y. N. Excurs. (1873). Vide 'The Flora of West Yorkshire,' p. 165.

271. **Hypericum montanum** L. Bearded St. John's-wort. 'Roadside, Whitley, 1886, one or two plants; C. P. Hobkirk.' Not indigenous there; probably introduced. Vide 'The Flora of West Yorks.,' p. 174.

306. **Erodium moschatum** L'Hérit. As 'wool' or 'grain' introduction, Heckmondwike (F. A. Lees).

331. **Medicago sativa** L. Purple Medick. Lucerne. Waste ground, Horbury Bridge. Not indigenous. [*M. lappacea* Desr., *M. arabica* All., *M. murex* Willd., and *M. marina* L., are foreign medicks which have occurred at various times about mills, on wool-waste heaps, etc., at Heckmondwike. Vide 'The Flora of W. Yorks.,' p. 784.]

To follow 362. **Trifolium agrarium** L. Mirfield; 'occasionally in clover fields, introduced with other seed.' Vide 'The Flora of W. Yorks.,' p. 196.

365. **Anthyllis vulneraria** L. Kidney-vetch. Clover-field, Dudfleet, Horbury (W. Rushforth).

378. **Coronilla varia** L. Abundant in a grass-field, Hungerhills (Miss A. A. Cocker, 1886). A casual.

To follow 406. **Cicer arietinum** W. Chick-pea. Alien. 'Occurs casually on wastes amid refuse from flour-mills, etc. Has so occurred at Mirfield.' Vide 'The Flora of W. Yorks.,' p. 203.

409. **Prunus domestica** L. Wild Plum. Alien. Planted in Coxley Wood. Not indigenous, except in W. Asia.

412. **P. padus** L. Bird Cherry. Kirklees Wood; Y. N. Excurs. (1873). Vide 'The Flora of West Yorkshire,' p. 205.

425. **Rubus rhamnifolius** W. & N. Roadside, by Soothill Wood (F. A. Lees, and P. F. Lee).

437B. **R. salteri** var. **calvatus** Blox. Hedge, Haybeck. At page 217 of 'The Flora of West Yorkshire,' Mr. Lees describes this as a form between *R. villicaulis* and *R. macrophyllus*. The Second Annual Report of the Watson Botanical Exchange Club (1886), contains the following note by Prof. Babington concerning specimens taken from the same plant and sent to him—'Seems to be *salteri*'; and the Third Report (1887) again referring to the same plant, still labelled *R. villicaulis* Koehl., says :—'I adhere to my former determination. If I must decide between *salteri* and *calvatus* I should say the latter,' C. C. Babington. In the meantime I had sent to Prof. Babington, as desired by him, some sprays in bloom, and I must now place it as above, instead of 439.

461B. **R. lejeunei** var. **festivus** (M. & W.). Wall bordering Soothill Wood (1886). Prof. Babington says this form is 'very near to *festivus*' (Watson Club's Third Report).

471B. **R. corylifolius** var. **conjungens** Bab. Creeping over stone-heap, field near 'Bulrush' mill-dam, Batley. ('near' teste F. Arnold Lees).

R. podophyllus Müll., nom. teste C. C. Babington. This form of the Bramble or Blackberry is an interesting addition not only to the flora of the district, but to that of Britain, and for the present it has no number in the London Catalogue of British plants. It really takes the place of 455 (*Rubus radula*) in my 'Flora of Dewsbury and Neighbourhood,' as I sent specimens of it bearing that name to Prof. Babington for confirmation. In the above list of new localities it may be noticed that I have gathered true *R. radula* (teste F. A. Lees) since my 'Flora' was first issued,

therefore 455 will stand with the new locality added. I first found *Rubus podophyllus* in August, 1885, localising it—'Copse, Soothill, near Dewsbury,' and it was then looked upon by the Record Club as a form of *R. radula*. During the autumn of the following year I took a number of good specimens from the same fine prostrate bush, and, acting as Distributor for the Watson Botanical Exchange Club, in the early part of 1887, I sent them with the Club's *Rubi* to Prof. Babington, the Referee for this Genus, who stated (see Watson Club's Third Report, 1887) 'they were not the sub-sp. *R. radula*, but that in his opinion they were *R. podophyllus* Müll., a continental form.' In 1886 the same form was gathered in North Wales by the Rev. W. Moyle Rogers and submitted to Prof. Babington (Journal of Botany, January, 1887). I sent a note to the 'Naturalist' referring to this addition to our native flora (The Naturalist, 1887, p. 276). See also 'The Bot. Rec. Club' Report, 1884-5-6, p. 121; 'Watson Bot. Ex. Club,' Third Annual Report, 1886-7, p. 4; and 'The Flora of West Yorkshire' (1888), by F. A. Lees, p. 787.

579. **Myriophyllum spicatum** L. Spiked Water-milfoil. 'Kirklees district; Y. N. Excurs. (1873).' Vide 'The Flora of West Yorks.,' p. 238.

651. **Œnanthe fistulosa** L. Water Drop-wort. 'Beside the mill at the end of Horbury Bridge, 1792; D. Dixon.' See 'The Flora of West Yorks.,' p. 257. I have failed to find it there this year (1888). Doubtless it has succumbed to the rank growth of the commoner species *Œnanthe crocata*, thereabouts.

669B. **Galium palustre** var. **elongatum** Presl. Water Bedstraw. The stout form with larger fruit, ditch, Howley (F. A. Lees and P. F. Lee).

788. **Senecio saracenicus** L. Broad-leaved Ragwort. Canal-side, Mirfield, naturalized (T. H. Bartlam). 'Soothill Wood, Batley; Neville (1873), Y. Nat. Rec., 220,' vide 'The Flora of West Yorkshire,' p. 293. I have never seen it in this wood.

800. **Carduus crispus** L. Welted Thistle (distinctly the var. *acanthoides*, with larger flower-heads, bracts with a stout spine, and fruit pale brown, glabrous, granulate, with an angled crown). Waste ground near Horbury Railway Station (H. T. Soppitt and P. F. Lee).

817. **Centaurea scabiosa** L. Hard-heads. Dry pasture bank, Horbury (W. Rushforth).

To follow 818. **Centaurea melitensis** L. (=*collina*). Star Thistle. Corn-field, Thornhill Lees. 'Casual, introduced with grain or wool from South Europe . . . . occurring with increasing frequency.' See 'The Flora of West Yorkshire,' p. 284.

863c. **Hieracium vulgatum** var. **rubescens** Backh. Storr's Hill, Ossett.

872. **H. umbellatum** L. Whitley; Hudd. Nat. Hist. Vide 'The Flora of West Yorkshire,' p. 311.

882c. **Taraxacum officinale** var. **palustre** DC. This moorland variety of the common Dandelion with almost entire leaves, deep red leaf-veins and stems, and broad outer involucral bracts, seems to be the prevailing form in a moist undrained pasture. Hungerhills (occurring with *Genista tinctoria*, *Pedicularis sylvatica*, etc.).

920. **Erica tetralix** L. Cross-leaved Heath. Stocks Moor, in one place only (H. T. Soppitt and P. F. Lee).

940. **Hottonia palustris** L. Water Violet. Local and rare. Several plants in a sluggish brook, Horbury (W. Rushforth).

952. **Lysimachia nummularia** L. Creeping Jenny. Herb-Tuppence. 'Batley; G. Roberts; vide 'The Flora

of West Yorkshire,' p. 378. Not indigenous here and probably introduced, if it does not refer to (953) *Lysimachia nemorum*.

957. **Anagallis arvensis** var. **cærulea** Schreb. The rare form of the Pimpernel with bright blue flowers. Mr. W. Smith, an old resident at Dewsbury Moor, informs me that some years ago he used to see it in corn-fields there occasionally. It may have been only the *arvensis* var. *pallida* with white corolla and purple eye, sometimes observed. The more erect *cærulea* is very rare.

989. **Anchusa sempervirens** L. Evergreen Alkanet. 'Gomersal, by roadside; J. Emmet.' See 'The Flora of West Yorkshire,' p. 370.

990. **A. arvensis** Biel. Small Bugloss. Waste ground, Horbury Bridge (G. W. Parker). A colonist, only observed here during the hot summer of 1887.

To follow 1006. **Echinospermum lappula** Lehm. An alien member of the *Boragineæ*, casually introduced with wool-waste, its seed envelope being burr-like. By old corn mill, Carlinghow.

Amsinckia lycopsoides Lehm. A Californian Casual. 'An increasing, fugitive Casual; on waste ground by rivers where the siftings of grain have been out-thrown (in fields more rarely). Of quite recent appearance.' Mirfield; vide 'The Flora of West Yorkshire,' p. 372.

1019. **Datura stramonium** L. Thorn Apple. 'Alien; occurring casually on waste ground or in patches of cultivated ground. Near the dog-house at Lupset; D. Dixon.' Vide 'The Flora of West Yorkshire,' p. 333.

1137½. **Stachys palustris × sylvatica.** Hybrid nearer the Marsh Woundwort than the Hedge Woundwort, and more common than Smith's hybrid *S. ambigua*, which is nearer *sylvatica* than *palustris*. Margin of 'Bulrush' mill-dam, Carlinghow, Batley (1887). Also see 'The Flora of West Yorkshire,' p. 794. In a damp hedge

bottom in this district, I once found a similar hybrid but nearer *palustris* than this one.

1147. **Leonurus cardiaca** L. Mother-wort. One large plant, waste garden plot at a farm, Whitley; used by inhabitants 'for pains in the back.' Not indigenous.

1150. **Lamium hybridum** Vill. (sub.-sp.). Cut-leaved Dead-nettle. Waste ground, Horbury Bridge.

1187. **Chenopodium rubrum** L. Red Goose-foot. Two plants on a wool-waste heap, Batley.

Atriplex hortensis L. var. **rubra** Lond. Encycl. Alien. 'On waste ground by Spen Vale Mills, Heckmondwike (1887) with *Xanthium spinosum*, various *Meliloti*, etc!' Vide 'The Flora of West Yorks.,' p. 795.

1221. **Rumex conglomeratus** Murr. Leafy-panicled Dock. Margin of 'Bulrush' mill-dam, Batley. Not common like its congener *R. obtusifolius*.

1225. **R. pulcher** L. Fiddle Dock. Alien. 'Once noticed (as a casual) on rubbish under a garden wall at Hartshead, near Kirklees.' Vide 'The Flora of West Yorkshire,' p. 387.

1227 **R. acutus** L. (*R. pratensis* M. and K.). Meadow Dock. 'Kirklees district; 'Y. N. Excurs. List, Yorks. Nat. Recorder' (1873), p. 190. 'Perhaps a misnomer.' See 'The Flora of West Yorkshire,' p. 387.

1262. **Mercurialis annua** L. Casual. 'This has occurred on rubbish and in cultivated ground twice only—as a garden weed, Rider's Nursery, Moortown (seeds no doubt brought with Rhododendrons or other roots from the South of England), and at Whitley near Mirfield; H. F. Parsons (1878). Vide 'The Flora of West Yorkshire,' p. 396.

1269. **Parietaria diffusa** Koch. Wall Pellitory. Mirfield; T. W. Gissing, vide 'The Flora of West Yorkshire,' p. 397.

1280. **Salix pentandra** L. Bay-leaved Willow. Two or three shrubs and one fairly large tree by Coxley Dam (Mrs. P. F. Lee, 1887). Perhaps these may have been planted as suggested by Mr. F. A. Lees in 'The Flora of West Yorkshire,' p. 797; but I think it scarcely likely, as they seem wild enough.

To follow 1314. **Populus balsamifera** L. Balsam Poplar. Alien. Several strongly-growing suckers in an old lane near Bretton Park. This is an ornamental planted tree with leaves glaucous-silvery beneath, and probably is in the Park.

1380. **Narcissus pseudo-narcissus** L. Daffodil. Corner of pasture, near an old orchard, Birstal. Most likely an escape.

1400. **Allium vineale** L. Crow Garlick. Hedge-bank near R. Calder, Horbury (W. Rushforth). I think the *Allium oleraceum* on p. 798 of 'The Flora of West Yorkshire,' will only be this, as it came from the same place. Mr. Lees only saw a dried poor specimen. He has this year (1888) seen good specimens from there and pronounced them *vineale*.

1424. **Paris quadrifolia** L. 'True-love'. 'Lupset Woods, 1792; D. Dixon.' Vide 'The Flora of West Yorkshire,' p. 441.

1454B. **Luzula campestris** var. **erecta** Desv. This variety of the Field Wood-rush, the one most frequent on moors and heaths, occurs here and there on Stocks Moor. It is much larger and stouter than the type.

1457½. **Sparganium ramosum** var. **microcarpum** of Neumann. New Record, Vice-County 63, S.W. Yorks. Marshy corner of thicket, near Bretton (1887). This variety of the Branched Burr-reed has fruit resembling *S. neglectum*, the new segregate added to the British Flora by Mr. W. H. Beeby, a few years ago. My specimens were submitted to Mr. Beeby

who stated that they were the above-named var. Mr. Arthur Bennett, F.L.S., of Croydon, in a letter, received from him in May, 1888, says:—The var. of *Sparganium ramosum* is a continental one, not yet in our manuals; it will be published in a Swedish Monograph of the Order separately, and conjointly with the new edition of Hartmann's Handbook of the Scandinavian Flora (ed. 12). It is the form of *ramosum* that *is* (!) continually mistaken for *neglectum*. Vide 'Watson Bot. Ex. Club,' Fourth Annual Report, 1887-8, p. 13, and 'The Naturalist,' 1888, p. 200.

1461. **S. minimum** Fries (sub.-sp.). 'Pond at Gomersal (Spen Valley), introduced; J. Emmet in Miall's Fl.;' vide 'The Flora of West Yorks.', p. 412.

1464. **Acorus calamus** L. Sweet-flag. Mace-root. Abundant in a wet waste piece of ground, Horbury Bridge (W. Rushforth). Rare. Evidently *not* planted as has been suggested (vide 'The Flora of West Yorkshire,' p. 412) is the case where it occurs in other parts of the Calder Valley, at Kirkheaton, Sandal, Walton, &c.

1475. **Butomus umbellatus** L. Flowering Rush. 'Milldam at Gomersal; W. Fowler (1870). Introduced there'; vide 'The Flora of West Yorkshire,' p. 421.

1501. **Potamogeton pusillus** sub.-sp. **friesii** Rupr. (=*mucronatus* Schrad.). Canal, Savile Town. 'A rather robust but flowerless plant—may be this'; vide 'The Flora of West Yorkshire,' p. 417.

1564. **Carex paniculata** L. Greater Panicled Sedge. Stagnant ditch, Thornhill Lees; canal-bank, Savile Town. Rare.

1598. **C. præcox** Jacq. Vernal Sedge. Meadow bank, Birkenshaw (1888).

1616D. **C. flava** var. **argillacea** Towns. A rare form of the Yellow Sedge. Coxley Valley. See 'The Flora of West Yorkshire,' p. 472.

1623. **C. ampullacea** Good. Bottle Sedge. 'Bulrush' mill-dam, Batley.

1642. **Alopecurus agrestis** L. Slender Fox-tail Grass. Corn-field, Horbury.

1724. **Festuca sciuroides** Roth. (sub.sp.). Barren Fescue Grass. Storrs Hill, Ossett.

1751c. **Agropyron pungens** var. **pycnanthum** G. & G. (sub.-sp.). 'A glaucous plant with tufted stems and involute leaves, gathered by P. F. Lee in July, 1886 [then misnamed *A. repens* var. *barbata*] on waste ground by a road-side at Haybeck, West Ardsley—possibly brought with ballast from some sea-coast.' A casual. See 'The Flora of West Yorkshire,' p. 496.

1773. **Asplenium trichomanes** L. Maiden-hair Spleen-wort. Wall, Bretton Park (F. W. Ridgway).

1778d. **A. filix-fœmina** var. **rhæticum** Roth (=*convexum* Newm.). An uncommon form of the Lady Fern. Coxley Valley.

1781. **A. ceterach** L. 'Rustyback.' Old garden walls, Kirklees Park, 'abundant!' H. Baines, 'The Flora of Yorkshire' (1840). Would not be indigenous there; no doubt introduced.

1782. **Scolopendrium vulgare** Sm. Harts'-tongue. Old pit-shaft, Coxley Valley, 1888. Happily out of reach (P.F.L.).

1793b. **Nephrodium filix-mas** var. **affinis** Fisch. ('near,' fide F. Arnold Lees). Pinnules oblong-lanceolate incised less crowded. Copse by stream at Hartley Bank, Horbury.

1801. **Polypodium vulgare** L. A few years ago, two plants on bank of streamlet in Coxley Wood (W. Rushforth). Not since observed in the district.

1802. **P. dryopteris** L. Oak Fern. 'Soothill Wood,—gone.' Vide 'The Flora of West Yorkshire,' p. 514.

1811. **Equisetum maximum** Lamk. Giant Horsetail.

'Haw Wood, Gawthorpe; T. W. Gissing.' Vide 'The Flora of West Yorkshire,' p. 520.

1856. **Nitella flexilis** Ag. Ditch, Howley.

REPORTS AND PROCEEDINGS
OF THE
BOTANICAL SECTION
OF THE
YORKSHIRE NATURALISTS' UNION.

REPORT ON YORKSHIRE BOTANY FOR 1885.

PHANEROGAMIA.

P. FOX LEE,

Dewsbury; Phanerogamic Secretary to the Botanical Section.

(Read before Bot. Sect., Annual Meeting of Y.N.U. at Beverley, 22nd March, 1886).

During the past year the excursions have not been the means of adding very much information to that we had already gained in the Phanerogamic Botany of the interesting places visited.

Perhaps this may in part be owing to the unfavourable weather at Pocklington, the early visit to the Anston Stones district, and the lateness of the year at Blubberhouses, but probably the chief cause must be attributed to the limited working time afforded in a single day, at the distant places embraced in the year's programme.

The first excursion was to Anston Stones, and the adjoining extreme southern corner of the county, on April 30th. Many of the earlier blooming plants were noted, such as :- *Erophila vulgaris* DC., *Daphne laureola* L., one of the hybrids of *Primula vulgaris* Huds. and a profusion in every hedgerow of the Sloe and the Bullace (*Prunus communis* Huds. and subsp. *P. insititia* L.).

There were also a few nice flowering specimens of the Hen-bit Deadnettle (*Lamium amplexicaule* L.) and of *Lithospermum arvense* L., as well as colonies of that root-parasite, *Lathræa squamaria* L. and the delicious Morel, *Morchella esculenta*.

The Ploughman's Spikenard (*Inula conyza* DC.) *Asplenium adiantum-nigrum* L., and *Cystopteris fragilis* Bernh., were gathered, but they were only young plants. The total number, of Phanerogams and higher Cryptogams of the London Catalogue of British Plants, reached 127.

At the second excursion on Whit-Monday, the 25th of May, at Boroughbridge, 169 species were observed.

Among these were *Stellaria nemorum* L., *Orchis morio* L., and *Botrychium lunaria* Sw.

On the 24th of June, the third meeting was held at Pocklington, when an incessant downpour of rain almost brought the botanical records in the rarer plants to zero.

This state of affairs was much regretted, because for the first time in the history of the Union, there was no information available on the botany of the district proposed to be worked. Doubtless many good plants are to be found on the gentle slopes and in the ramifying dales leading to the higher grounds of this fringe of the wolds.

Geum intermedium Ehrh., and some fine specimens of the Tall Fescue-grass, *Festuca elatior* L., however were gathered, and altogether 161 flowering plants and ferns were observed.

The fourth meeting was held at Whitby, on Lammas Monday the 3rd of August. The number of Phanerogams seen in flower or fruit, including those noted in the district between Goathland and Grosmont by a small party from Scarborough, previous to the Union excursion, amounted to 252, amongst which were several of special interest from a distributional point of view, viz. :—*Inula heleninm* L., *Genista tinctoria* L., *Vicia bithynica* L., and *Lathyrus sylvestris* L. Twelve ferns were collected, bringing the total up to 264 species.

The excursion season of 1885 was brought to a close by an interesting meeting held at Blubberhouses, in Washburndale, on the 26th September, by invitation of the Right Hon. Lord Walsingham, M.A.

Owing to the late period of the year, only a meagre list of observations, viz. :—89 species of Phanerogams in flower or fruit, and ferns—was made, the most note-worthy being :—*Rosa villosa* sub-sp. *R. mollis* Sm., *Rosa canina* var. *subcristata* Baker, *Sonchus oleraceus* L., *Salix pentandra* L., and *Polypodium Dryopteris* L.

On the moorland, one plant of white heather (*Calluna vulgaris* Salisb.) was found. *Scabiosa succisa* L., and *Campanula rotundifolia* L., were also gathered with white flowers.

YORKSHIRE NATURALISTS' UNION.

BOTANICAL SECTION.

The Ninth Annual Meeting was held at Beverley, on the 22nd of March, 1886, Mr. J. A. Erskine Stuart occupying the Chair.

The Report on Phanerogamic Botany for the year 1885 [as printed at pages 267-9], was read by Mr. Lee, and adopted on the motion of Mr. Thomas Birks, Hull, seconded by Mr. M. B. Slater, Malton.

The following were elected as Officers of the Section for 1886 :—

President: Rev. WILLIAM FOWLER, M.A., Liversedge.

Secretary for Phanerogamic Botany:

P. FOX LEE, Dewsbury
(re-elected).

Secretary for Cryptogamic Botany:

M. B. SLATER, Malton.

A vote of thanks to the retiring Officers, passed unanimously, on the motion of Mr. H. T. Soppitt and Mr. R. T. Thornton, concluded the business.

The Tenth Annual Meeting was held at Dewsbury, on the 14th of March, 1887, Mr. F. Arnold Lees, L.R.C.P., &c., in the chair.

Reports on Yorkshire Botany for 1886, Phanerogamic and Cryptogamic, by the Secretaries, Messrs. P. Fox Lee and M. B. Slater, were read by those gentlemen, and adopted on the motion of Mr. J. A. Erskine Stuart, Staincliffe, near Dewsbury, seconded by Mr. R. Thornton, Dewsbury.

The following were elected as Officers of the Section for 1887 :—

President:

F. ARNOLD LEES, L.R.C.P., &c., Heckmondwike.

Secretary for Phanerogamic Botany:

P. FOX LEE, Dewsbury
(re-elected).

Secretary for Cryptogamic Botany:

MATTHEW B. SLATER, Malton
(re-elected).

REPORT ON YORKSHIRE BOTANY FOR 1886.

PHANEROGAMIA.

P. FOX LEE,
DEWSBURY; PHANEROGAMIC SECRETARY TO THE BOTANICAL SECTION.

(Read to the Annual Meeting of the Botanical Section at Dewsbury, 1887).

The meetings of the Yorkshire Naturalists' Union for 1886 have not produced as much real botanical work among the Phanerogams and higher Cryptogams embraced in the London Catalogue of British plants, as in former years. There is no new record to be made in the geographical distribution of plants. Several rare plants have been collected at the four meetings held during the year, but the whole of them were at previously known stations.

The opening meeting was held at Askern, on Thursday the 20th May. The typical flora of the neighbourhood of Askern is more a late summer one, owing to the ditches and wet ground with which the district abounds, consequently at the first meeting so early in the year as the 20th of May, coupled with adverse meteorological conditions, viz. :—a cold wet day, and much of the country proposed for investigation being flooded from the excessive rainfall of the previous week or two, the botanical results presented but a meagre record. Only 92 observations were made, and these mostly the common early-flowering species.

The next meeting on the 14th of June, at Flamborough Head, only allowed a limited time for investigating the flora of that interesting district of East Yorkshire. The botany of this calcareous coast-line, and the country inland, as indeed may be said of the whole of East Yorkshire, is but imperfectly known, and would be well worth the careful attention of the Botanical Section. We already have good Floras of both the North and West Ridings, and the section might with advantage, both to

itself and to botanical science generally, arrange for publishing well-authenticated and verified contributions towards a future East Riding Flora. 163 was the total number of species noted, the best of which were — *Aquilegia vulgaris* L., *Spiræa filipendula* L., *Campanula glomerata* L., *Armeria vulgaris* Willd., the normal red-flowered form and also a white flowered form, *Orchis morio* L., *Orchis mascula* L., and *Fritillaria meleagris* L.

The third meeting, Saturday, July 17th, was planned for the investigation of the upper part of the lovely valley of the Nidd, and the picturesque scenery of the How Stean Beck, Pateley Bridge being the rendezvous. The flowering plants, ferns, &c., gathered numbered 146, the following moderately rare species being among them:—*Stellaria nemorum* L., *Cnicus heterophyllus* Willd., *Habenaria bifolia* Br. (the sub-sp. *H. chlorantha* Bab.), and *Stachys ambigua* Sm., a hybrid nearer *Stachys sylvatica* than *Stachys palustris*. It approaches the former in its reddish-purple flowers, and the latter in its hollow stem, the leaves being shortly petioled, and the fruit never maturing.

The fine district of Newtondale, near Pickering, with the open moorlands beyond, was chosen as the place for the last meeting of the year, on Monday the 2nd of August. Many uncommon plants were seen, including the following :—*Cornus suecica* L., in its old habitat, but not in flower. On the adjacent moorlands :—*Vaccinium oxycoccos* L., *Empetrum nigrum* L., *Genista anglica* L. In Newtondale and the adjoining woodlands :—*Lotus corniculatus* L. sub-sp *L. tenuis* Waldst and Kit., *Carduus nutans* L., *Cnicus eriophorus* Hoffm., *Inula conyza* DC., *Crepis paludosa* Mœnch., *Veronica buxbaumii* Ten., *Anagallis tenella* L., *Orchis pyramidalis* L., *Habenaria conopsea* Benth., and *Epipactis latifolia* Sw.

The total number of observations was 293, nine of these being ferns of wide distribution, making a total for the whole of the meetings of 694.

REPORT ON YORKSHIRE BOTANY FOR 1887.

PHANEROGAMIA.

P. FOX LEE,

DEWSBURY; PHANEROGAMIC SECRETARY TO THE BOTANICAL SECTION.

(Read to the Annual Meeting of the Botanical Section at Malton, 1888).

All the five meetings for 1887 have been held at very interesting botanical centres, and a goodly number of new records, both vice-comital and local, have to be registered.

At the first meeting, held at Saltburn-by-the-Sea, on Whit-Monday, the 30th of May, the district explored was from Guisborough, following the course of a winding stream to Saltburn. Among the rarer plants of the nearly eighty species noticed, the following may be mentioned :—*Cardamine amara* L., *Glaux maritima* L. (on the coast), *Myosotis sylvatica* Hoffm., *Atropa belladonna* L. (not in flower), *Mentha viridis* L. (a large patch of this, the ordinary Spear-mint of gardens, seen growing by the stream-side, evidently thoroughly naturalized), *Iris fœtidissima* L. (this rare plant noted in the glen ; not in flower, however, at this early season, and very doubtfully indigenous), and *Prunus padus* L.; *Scolopendrium vulgare* Sm., was the only fern observed.

The next excursion and meeting was held on July 20th, in response to the special invitation of the President, Sir Ralph Payne-Gallwey, Bart., at Gormire Lake and at his seat at Thirkleby Park. This meeting brought forth a new vice-county record for north-east Yorkshire, viz. :—*Potentilla argentea* L.,

gathered on the new red sandstone at Breckenbrough, east of the Wiske stream (the dividing line between vice-counties 62 and 65), and some three miles west of Thirsk.

Next to this the most important observation made was that of the singular hair-clothed *Veronica parmularia* Tur. and Poit., from a pool near Gormire ; and, singular to say, reported as found growing intermixed with the perfectly glabrous 'type' *Veronica scutellata*—a fact that makes it difficult to account adequately for the very distinct aberration it presents, upon any theory of special conditions due to local environment ; and, seeing that its special characters have remained constant under cultivation, lends probability to suggested specific distinctness.

The 'Gormire bramble' recorded in 'North Yorkshire' under the name of *Rubus nitidus* (= *R. lindleianus* Lees), was observed to be very abundant on the sandy soil of the slopes above the lake, and noted to have a peculiar facies, due to its neat habit of growth, small neat quinate leaflets, and racemose hairy panicle of flowers, with patent sepals and narrow lilac-grey petals. No special name has been given it, although Mr. J. G. Baker himself says it is not quite like any form known to him ; and further, *R. lindleianus* (*nitidus* Bell Salt.) is said in Stud. Flo., 118, to be unknown on the continent, i.e., not correlatable with any continental type. Under these circumstances it seems a pity that it has no scientific cognomen ; to remove which disability and connect the name of John Gilbert Baker by one more (and that a natural) link with his native county, for the botany of which he has done so much, it is proposed by the President of the Botanical Section (Mr. F. Arnold Lees) to name it, *Rubus bakeri* (provisionally, at any rate, until shown to be identified with some form already named), and to give it this title, not as a distinct species, but as a variety of the *Rubus affinis* of English authors (said by Mr. Baker to be essentially the same super-species as *R. montanus* Wirtg.), intermediate between *R. nitidus* Weihe (of the *suberecti* Section) and *R. carpinifolius* Weihe (and Bab. Man.), to which rather

than to *R. lindleianus* its racemose narrow panicle and hairy rachis approximates it.

The other plants noticed in stations *not* given in 'North Yorkshire' were *Chara fœtida* var. *atrovirens* (Decoy pond, Thirkleby), of which the wild and decoy ducks were said to be very fond; *Typha angustifolia* and *Carex vesicaria* (Decoy); *Pyrus communis* (hedge, bird-sown, near Whitestonecliff); *Hypericum humifusum* and *Erythræa centaurium*, in dry places; and *Scolopendrium vulgare*, on Whitestonecliff; whilst the colonising casual, *Diplotaxis muralis*, with its large branched state *babingtonii*, was seen to be getting well established on waste ground by the sidings at Thirsk Station, on which for thirty years or more its near ally, *D. tenuifolia*, has been known to exist.

On Bank-holiday Monday, the 1st day of August, the third meeting was held at Sedbergh in the extreme north-west of the County, and the Howgill Fells, Cautley Spout and the valley of the Lune were well investigated. 'No excursion of the Union has been more successful or fertile in discovery than this one. The great bulk of the species noted were, of course, already known, and entered for their stations in the 'Flora of West Yorkshire', e.g., *Alchemilla alpina*, *Epilobium alsinifolium* (with its large form, *anceps* Fr.), *Saxifraga stellaris* and *Circæa alpina*; but the day's labours resulted in the observance of five species new to the Flora for that part of the Lune river-basin under examination. These are:—*Saxifraga aizoides* (gill between Winder and Crook Fells—J. Backhouse, junr.); *Galium boreale* (near the Lune bank); *Hieracium crocatum* Fr. (banks at Howgill); *Hieracium umbellatum* L. (Lune-side banks), and *Linaria minor*, but this last is, properly regarded, adventive to the district. At Cautley 'Spout' the Film-fern (*Hymenophyllum unilaterale* Willd.) was seen growing in massed abundance (in shrivelled state) on rocks *many yards* away from the much reduced stream at *this* time—evidence both of the

exceptional drought and the wide-spreading spray of the cascade when in its normal volume.'

The next meeting was held on the 27th of August, at Welton Vale, near Brough, a picturesque little valley excavated in the wolds. Many good flowering plants were gathered, including :—*Malva rotundifolia* L., *Astragalus glycyphyllos* L. (in fruit), *Scabiosa columbaria* L., *Campanula rapunculoides* L. (an escape), *Campanula glomerata* L., *Gentiana amarella* L., *Juncus obtusiflorus* Ehrh., and *Apera spica-venti* Beauv.

The seventieth meeting of the Union and last one for 1887, taking the place of a Fungus Foray announced and subsequently postponed to another year, was held at Hatfield, for the far-famed Level of Hatfield Chace, a district hitherto but little explored. A good search was made over the undrained peaty tract for *Drosera intermedia* Hayne, and the rarer species *Drosera anglica* Huds., as well as for *Osmunda regalis* L. (in thickets about the Chace) all three likely to be found here—the investigators being so intent upon the work that they got lost, and only learnt their whereabouts on emerging at Wroot in Lincolnshire ! —but no traces of these plants could be discovered.

Andromeda polifolia L., was fairly abundant among the Ling and Cross-leaved Heath on the Chace, and a few half withered specimens of *Rhynchospora alba* Vahl., were noted. In the drains and on the peaty banks of ditches occurred *Stellaria aquatica* Scopoli, *Hydrocotyle vulgaris* L., *Hippuris vulgaris* L., *Potamogeton pusillus* var. *tenuissimus* M. and K., and *Carex pseudocyperus* L.

On the sandy drives, stubble-fields, &c., the best things observed were *Papaver dubium* L., *Spergularia rubra* Pers., *Erodium cicutarium* L'Hérit., *Rubus suberectus* var. *fissus* Lindl., *Dipsacus sylvestris* L. (abundant on the banks of one of the large drains), *Scleranthus annuus* L., and *Hordeum murinum* L. The total number of species seen at this meeting was 142.

Other important Yorkshire discoveries are *Carduus acaulis* L., turf of moor above Rievaulx, New County Record for Vice-county 62 : *Calamagrostis epigejos* Roth., damp spinney by Blackburn dike, Hawes, alt. 750 feet—a considerable extension of its Yorkshire range, both north-westward and altitudinally. New County Record for Vice-County 65 *Sagina ciliata* Fries., Leyburn Flag quarries (F. A. Lees) ; New County Records for vice-county 63, *Asperugo procumbens* * L., Old quarry, Sandal, a casual (G. Roberts), and *Chara fragilis* var. *fulcrata* Gant., stagnant pool, old quarry, Sandal (P. F. Lee).

Hieracium eupatorium Griseb., Lune-side rocks, Sedbergh, 1887 (J. Handley), an addition to the West Riding Flora ; *Rubus podophyllus* Müll., open copse, Soothill near Dewsbury, in Vice-county 63, S. W. Yorkshire, 1885-6 (P. Fox Lee), an addition to the Flora of Britain.

The following correction and addition must be made to the Report for 1884 issued with part 9 of the Transactions :— *Rosa rubiginosa* (add, form *sylvicola*), Sandhills, Spurn Point, vide Bot. Rec. Club. Rep. 1884-5-6, p. 94.

YORKSHIRE NATURALISTS' UNION.

BOTANICAL SECTION.

The Eleventh Annual Meeting was held at Malton, on the 7th of March, 1888, Mr. J. A. Erskine Stuart occupying the Chair.

The Report on Phanerogamic Botany for the year 1887 [as printed at pages 273-7], was read by Mr. P. F. Lee, and adopted.

The following were elected as Officers of the Section for 1888 :—

President: F. Arnold Lees, L.R.C.P., &c., Leeds (re-elected).

Secretary for Phanerogamic Botany: P. Fox Lee, Dewsbury (re-elected).

Secretary for Cryptogamic Botany: Matthew B. Slater, Malton (re-elected).

The Twelfth Annual Meeting was held at Sheffield, on the 16th of November, 1888, the Rev. Wm. Fowler, M.A., of Liversedge, occupying the Chair.

The Reports of the Secretaries of the Section were read and approved.

The following were elected as Officers of the Section for 1889 :—

President: C. P. Hobkirk, F.L.S., Dewsbury.

Secretary for Phanerogamic Botany: P. Fox Lee, Dewsbury (re-elected).

Secretary for Cryptogamic Botany: Matthew B. Slater, Malton (re-elected).

REPORT ON YORKSHIRE BOTANY FOR 1888.

PHANEROGAMIA.

P. FOX LEE,
DEWSBURY; PHANEROGAMIC SECRETARY TO THE BOTANICAL SECTION.

(Read to the Annual Meeting of the Botanical Section at Sheffield, Nov., 1888).

At the four meetings held during 1888 (the successful Fungus Foray in September being outside the province of this Sub-Section) several interesting observations have been made, and at one of the meetings a new Yorkshire plant was recorded.

The first meeting was held in Lower Wensleydale at Leyburn, on May 21st. Amongst the rarer plants noted were :—*Cardamine amara* L., *Saxifraga granulata*, *Prunus padus* L., and *Adoxa moschatellina* L.

At the next meeting, on the moors at Saddleworth in June, this Section had the presence and assistance of several Lancashire botanists, including a former President of the Section, viz. :—Mr. Thomas Hick, B.A., B. Sc. In several places on the higher flanks of the moors there was seen an abundance of *Rubus chamæmorus* L., in fine bloom. In boggy ground near one of the water-courses occurred the broad-leaved uncommon form of the Cotton-grass, *Eriophorum angustifolium* var. *elatius* Koch. An unsuccessful search was made for *Malaxis paludosa* Sw., at Gulliver's swamp, its only West Yorkshire habitat. *Cystopteris fragilis* var. *dentata* Hook., and *Hymenophyllum unilaterale* Willd., were both gathered at Seal Bark Rocks where they have been long known, and *Nephrodium filix-mas* var. *borreri* by the stream at the foot of the rocks.

The third meeting was held at Robin Hood's Bay on July 16th, a continuous downpour of rain rendering it unfit for

much exploration, consequently only such plants as possess a wide and general distribution were noted.

The Bank Holiday excursion, on August 6th, was in the neighbourhood of Market Weighton, when over 200 Phanerogams and higher Cryptogams of the Lond. Cat. of British Plants, were observed.

The most interesting 'find' of the season has been *Goodyera repens* Br., making an addition to the Flora of Yorkshire, some fine examples of this rare member of the *Orchideæ* being obtained at Houghton Hall Woods, near Market Weighton. The distribution of *Goodyera* hitherto, was, fir woods in E. Scotland, from Cumberland, Berwick (your Secretary has gathered it at Mellerstane Woods, where it grows freely, its root-stock creeping amongst the decayed fir leaves), and Ayr to Ross. Being of a northern type, its appearance in Yorkshire, may possibly be accounted for by its having been accidentally introduced with coniferous plantings.

Other Yorkshire discoveries during 1888 are:—*Cynoglossum officinale* L., at Hawbank Quarry, Skipton-in-Craven, New Record for Aire river-basin district (T. W. Edmondson). *Stratiotes aloides* L., at Carlton near Selby, first record in the Aire drainage district (Thomas Bunker). *Pyrola rotundifolia* L., wood at Outershaw, Langstrothdale, at 1,200 ft. altitude, New County Record for Vice-County 64, Mid-West Yorkshire (T Basil Woodd). *Sparganium ramosum* var. *microcarpum*, in the marshy corner of a small thicket near Bretton, S. W. Yorkshire, New County Record for Vice-County 63 (P. Fox Lee).

INDEX.

INDEX

(Compiled by Wm. Denison Roebuck).

The **heavy type** *denotes titles of the principal articles, and important subjects.*

The italic type is used for authors, persons, places, and minor subjects.

The ordinary type *for the names of genera and sub-genera.*

PAGE

Abbott, James 85 87 104 105 106 107 108 109 120 207 208 210 211 212 213 214 216 217 221 222 224
Acer 136 230
Achillea 48 148 236
Achnanthidium 108
Aconitum 11 21 114 127
Acorus 164 262
Actæa 32 127 253
Adoxa 145 235 252 279
Ægidium 27 100 222
Ægerita 101 222
Ægopodium 142 234
Æthalium 98
Æthusa 143 234
Agaricus 8 26 39 67 68 69 83 94 95 207 208 210
Agrimonia 138 233
Agropyrum 247 253 263
Agrostis 177 246
Ainactis 28
Aira 48 178 246
Ajuga 158 241
Alchemilla ... 46 65 74 138 233 275
Alicularia 93
Alisma 166 244
Allium ...34 70 76 121 171 243 261
Alnus 163 242
Alopecurus 177 246 263
Alsine ... 19 65 67 73 86 133
Alyssum 129
Amanita ... 26 39 94 95 207 210
Amblystegium 37 60 67 68 80 92 110
Amphipleura 108
Amphora 43
Amphoridium 66 78
Amsinckia 11 22 259
Anacalypta 90
Anagallis ... 48 86 160 238 259 272

PAGE

Anchusa 22 158 259
Anderson, S.... 37
Andreæa ... 11 22 65 66 77 78 87
Andrews, H. ... 74 86 87 97
Andromeda 5 49 276
Anemone 85 125 126 225
Aneura 24 63 94
Angelica 143 235
Angioridium... 221
Anomodon 47 52 66
Anston Stones, Notes from ... 267
Anthelia 66
Anthemis 147 148 236
Anthina 101
Anthoxanthum ... 177 246
Anthriscus 234
Anthyllis 4 46 136 255
Antirrhinum... .. 154 205
Antitrichia 92
Apera 70 76 276
Aphanocapsa 28
Apiocystis 106
Apium 6 20 234 252
Aquilegia 127 226 272
Arabis 46 129 227
Archidium 54
Arctium ... 31 70 74 118 147 237
Arenaceous Soils, Plants of ... 47
Arenaria 30 133 229
Argillaceous Soils, Plants of... 48
Aristolochia 162
Armeria 272
Armillaria 26 95 211
Arrhenatherum 246
Artemisia 148 206 236
Arthrodesmus 71 84
Arum 165 243
Asarum 242
Ascham, Anthony 187

PAGE
Aschamia 187
Ascobolus 103 223
Askern, Notes from 271
Askham Bog, Notes from ... 68 72
Asperugo 277
Asperula 10 20 146 235
Aspidium 87 182
Asplenium 21 32 46 65 77 123 181 204 247 263 268
Astragalus 10 19 137 276
Aster 5
Athyrium 182 247 263
Atrichum 58 69 79
Atriplex ... 6 17 161 206 241 260
Atropa 18 153 273
Aulacomnium ... 36 58 68 79
Auricularia 97
Avena 178

Babington, Prof. C. C. ... 9 256
Bacillaria 107
Bactridium 221
Baines, Henry 53
Baker, J. Gilbert 3 13 89 185 202 204 225 254 274
Ballota 157
Barbarea ... 70 73 129 205 227 254
Barbula 23 35 37 55 56 66 67 70 78 88 90
Barker, Prof. Thos. 36
Barnes, Mr. 44 35 36
Bartlam, John 85
Bartlam, T. H. 85 258
Bartramia 48 66 69 79 91
Bartsia 155 240
Batrachospermum ... 28 40 69 83 104
Beeby, W. H. 261
Bellis 149 235
Bennett, Arthur 262
Berberis 11 127 253
Berkeley, Mrs. 127 128 129 130 134 140 145 147 148 150 151 152 153 155 158 166 169
Beta 254
Betula 163 242
Bidens 70 75 149 236
Binns, I. 236 237
Birks, Thomas 39 40 110 111 270
Bishop's Wood, Notes from ... 14 16
Bispora 222
Blechnum 181
Blepharozia 63
Blysmus 21
Blyttia 81 110
Boletus 209 218
Bolton, James ... 201 209
Boroughbridge, Notes from ... 268
Boswell, Henry ... 9 53 90 109 111
Boswell, Dr. J. T. ... 113 123

PAGE
Botrychium ... 184 203 248 252 268
Botrydina 106
Botrytis 101
Bovista 98
Brachyodus 90
Brachypodium ... 21 77 180
Brachythecium 24 36 48 59 80 92
Brassica 115 128 227
Breutelia 36 52 57 65 79
Brewer, Samuel ... 195 200
Breweria 195
Briza 179 246
Bromus 85 110 180 247
Brook, George 43
Brough, Notes from 12 16
Brunella : see Prunella
Brunton, Wm. 89 129 134 137 140 143 144 151 160 169 199 200
Bryonia 74 141
Bryum 23 36 57 67 79 88 91 110 194
Bulbochæte 105
Bulgaria 103 207 223
Bunium 142 234
Bunker, Thomas 280
Bupleurum 143
Butomus 166 262
Buxus 162

Calamagrostis ... 177 277
Calamintha 119 156 240
Calcareous Soils, Plants of ... 46
Caley, George 197
Callitriche 74 117 141 233
Calluna ... 118 151 238 269 276
Calocera 27 97 220
Calothrix 106
Caltha 126 226
Calypogeia 63 69 93
Camelina 227
Campanula ... 75 151 238 269 272 276
Camptothecium 59
Campylodiscus 43 109
Campylopus ... 35 49 54 66 78 88 89 90
Cantharellus 26 40 96 217
Capsella 130 227
Cardamine 19 29 86 128 129 227 273 279
Carduus 12 17 18 20 31 47 70 74 86 118 146 147 237 258 272 277
Carex 6 18 21 32 34 48 49 68 69 70 76 87 112 118 121 172 173 174 175 176 206 245 252 262 263 275 276
Carlina 147
Carpinus 22
Carr, Amos 29 30 31 32
Carrington, B. 9
Carter, James ... 142 154
Carter, J. W. 99
Castanea 22 163 242

PAGE

Caucalis 144 235
Catabrosa 179
Cenangium 103
Cenococcum 98
Centaurea ... 6 31 48 147 237 258
Centunculus 31
Cephalanthera ... 169 205
Cephalozia 38 62 63
Cerastium 132 228
Ceratium 101 222
Ceratodon 56 68
Ceratophyllum 31 243
Cetraria ... 25 39 44 52 67 69 81
Chærophyllum 10 17 48 144 234
Chætophora 28 69 83
Chantransia 104
Chara 18 32 77 85 110 248 275 277
Cheesman, W. N. 29 34 40 91 92 93
111 120 123 210 211 212 213 215
216 217 218 219 221 222 223 224
Cheiranthus ... .22 128
Chelidonium 128 226
Chenopodium ... 22 161 241 260
Chiloscyphus... ... 14 62 93
Chlora ... 47 75 152 206 238
Chroolepus 67 84
Chrysanthemum ... 48 147 236
Chrysosplenium ... 74 142 233
Cicer 33 255
Cichorium 119 149 237
Cicuta 142
Cinclidium 91
Cinclidotus 58
Circæa 31 140 334 275
Cladium 68 70 76 172
Cladonia ... 24 28 38 49 52 81 94
Cladophora 7 28 44 104
Clark, J. Edmund ... 216 221
Claudopus 39 213
Clavaria 97 207 220
Claytonia 116 229 252
Clematis 21 114
Climacium 23 59 68
Clitocybe ... 26 39 95 211 212
Closterium 8 41 69 84 107
Cnicus 204 237 272
Coccochloris 106
Cocconeis 108
Cocconema 42 108
Cochlearia 19 86 129 227
Cocke, Miss A. A. 255
Colchicum 76 171
Coleochæte 69 83
Coleosporium 100 222
Collema 24 28 38 47
Collybia 26 67 83 95 212
Comarum 49 139
Comatricha 221

PAGE

Conferva 8 104
Conium 17 144 234
Conocephalus 63
Conopodium: see Bunium
Convallaria 76 170
Convolvulus 153 206 239
Copley, Notes from 3
Coprinus 95 96 215
Cornus 118 144 272
Coronilla 255
Corticium 97 220 224
Cortinarius 39 96 215
Corydalis 48 69 128 226
Corylus 163 242
Cosmarium 8 40 41 84 107
Cotyledon 19
Cowthorpe Oak 4
Cratægus 117 140 233
Craterellus 40
Crebbin, A. 86 87 91 92 100
Crepidotus 39 214
Crepis 4 11 20 69 75 86 150 237 272
Cribraria 98
Crocus 85 170
Crucibulum 40 99 221
Cryphæa 23 52 59
Cryptogramme ... 46 65 77
Cucurbitaria 67 83
Curtis, Wm.... ... 197 198
Cuscuta 31 153 206 239
Cyathus 40 83 99 221
Cylindrospermum 40 106
Cylindrothecium 92
Cymatopleura 42
Cymbella 42 67 84
Cynoglossum... ... 20 47 159 280
Cynophallus 27 98 221
Cynosurus 179 246
Cyphella 220
Cystopteris ... 21 77 182 268 279
Cystopus 100
Cytisus : see Sarothamnus

Dacryomyces... .. ...27 220
Dactylis 179 246
Dædalea 69 97 219
Dalton, Rev. J. 129 138 143 144 146
166 199 201
Daphne 70 75 162 267
Datura 153 259
Daucus 144 235
Denny, Alfred 124
Dermocybe 96
Deschampsia... 246
Description and Plate of Carex saxumbra Lees 121-123
Desmidium 106

PAGE

Dewsbury Florula (P. F. Lee) 225—248 and 251—264
Dianthus 131
Diatoma 8 41 107
Diatrype 103 207 224
Dichæna 104
Dichodontium 78 89
Dickin, T. 33 34
Dicranella ... 35 48 54 66 69 78 89
Dicranum ... 23 52 54 67 69 87
Didymium 98
Didymodon ... 7 23 35 37 47 55 88 90
Digitalis 47 48 154 239
Digraphis 177
Dillenius, John Jacob 193
Diphyscium 66 79
Diplodia 99
Diplophyllum 62
Diplotaxis 275
Dipsacus 146 276
Distichium 35 66 78 91
Ditrichum ... 23 35 47 52 55 78 88 90
Doncaster, Notes from ... 69 72 203
Doronicum ... 11 22 33 119 149 236
Dothidea 103
Draba 29 32 46 65 73 86 129 227 267
Draparnaldia... ... ... 7 104
Drosera 5 49 70 73 115 131 204 276

Earnshaw, R. 1
East Riding Moss-Flora (H. F. Parsons) 51—61
East Riding Hepatic-Flora (R. Spruce) 62 63
Echinospermum 259
Echium 47 158 239
Edmondson, T. W. 280
Elodea 43 167 243
Elymus 87 180
Emmet, John 32 33 34 114 115 118 119 120 123 219 259 262
Empetrum 4 5 11 44 49 272
Emsley, Fred. 104 105 106 107 108 109
Encalypta ... 35 47 52 55 66 78 91
Encyonema 28
Endocarpon 25 39 47 83 94
Enteromorpha ... 12 28 40
Entoloma 8 213
Entosthodon 57 79 91
Ephemerum 57
Epichloe 103
Epilobium ...31 33 74 140 233 234 275
Epipactis 120 169 243 272
Epithemia 107
Equisetum ... 34 123 184 248 263
Eranthis 127
Erica ... 5 47 48 49 151 258 276
Erigeron 20 47 149

PAGE
Eriophorum 34 49 173 279
Erodium ... 33 135 206 230 255 276
Erophila : see Draba
Erysimum 21
Erysiphe 29 207
Erythræa 152 238 275
Eschscholtzia 254
Euastrum 71 84
Eucladium ... 23 47 66 67 78 90
Eunotia 107
Euonymus 85 136
Eupatorium 86 149
Euphorbia 31 162 163 242
Euphrasia 155 239
Eurhynchium ... 59 60 80 92
Evernia 4 66 81 94
Exidia 98 220

Fathers of Yorkshire Botany (J. G. Baker) 185—201
Fagus 47 163 242
Faull, J. 87
Fegatella 63 81
Fergusson, Rev. J. ... 9 23 43 109 111
Festuca 85 87 179 180 246 247 253 263 268
Filago 70 75 148
Filey, Notes from 203
Fisher, Samuel 193
Fissidens ... 36 58 65 66 79 88
Fistulina 218
Flamborough, Notes from ... 271
Flammula 214
Fœniculum 143
Foggitt, T. J. ... 29 30 31 119
Foggitt, W. 30
Fontinalis 36 58 69 79
Fossombronia 63
Fothergill, John ... 200 201
Fothergillia 201
Fowler, Rev. W. 1 2 9 31 37 40 43 44 109 110 111 131 166 202 207 226 235 262 270 278
Fragaria 139 232
Fragilaria 8 70 84
Frankland, Sir Thomas ... 200
Fraxinus 151 238
French, J. 1
Fritillaria 205 272
Frullania 38 63 66 80
Fuchsia 188
Fuchsius, Herbal of 188
Fumaria ... 29 73 110 114 128 226
Funaria 57 91
Fungi of Yorkshire, List, 1881 (George Massee) 209
Fungus Foray at Studley and Harrogate 207

PAGE
Gagea 34 170
Galanthus 170
Galeopsis ... 34 48 75 157 240
Galera 8 26 69 83 214
Galium 20 33 47 86 118 145 146 206 235 257 27 5
Gatty, Rev. R. 32
Geaster 208 221
Genista ... 46 117 136 230 268 272
Gentiana 5 17 20 31 47 70 75 152 258 276
Geoglossum 223
Geranium 11 19 22 46 85 116 134 135 203 230
Gerard, John 189
Geum ... 4 74 139 232 268
Gilia 254
Gissing, T. W. 260
Githago 228
Glaux 5 12 20 273
Glæocapsa 28 106
Glæocystis 106
Glyceria 32 123 179 246
Gnaphalium 118 148 235
Gomphogramma 43
Gomphonema ... 42 84 108
Gonium 84 109
Goodyera 280
Goole, Notes from 3
Gormire, Notes from 273
Graphis 66 82 94
Grimmia ... 35 46 56 66 78 88 91
Gymnadenia 87 168
Gymnomitrium 37 50
Gymnostomum ... 54 78 89
Gynerium 178
Gyrosigma 108

Habenaria ... 34 168 243 252 272
Habrodon 36
Hall, Hugh 119
Hambleton, Notes from ... 14 16
Handley, John 277
Haplomitrium 63
Harriman, Rev. J. ... 199 201
Harrison, John ... 41 42 43
Harrogate, Notes from... ... 67 72
Hatfield Chace, Notes from ... 276
Hebden Bridge, Notes from .. 69 72
Hebeloma 8 39
Hedera 144 235
Hedwigia 46 66 79
Heleocharis 244 245
Helianthemum ... 29 46 130 195
Helleborus ... 11 21 67 70 73 127 152
Helminthia 48 119
Helminthosporium 101
Helosciadium .. 70 74 142

PAGE
Helotium 67 83 103 223
Helvella 208 222 223
Hepaticæ of East Riding (Richard Spruce) 62 63
Heracleum 143 235
Hesperis ... 11 21 115 128 227
Heterosphæria 103
Hick, Thos. 29 43 87 110 111 123 124 202 208 279
Hieracium 20 31 48 75 110 150 151 193 237 258 275 277
Himantidium 8 109
Hindson, Isaac 67
Hippophae 206
Hippuris 117 141 276
Hobkirk, C. P. 1 23 35 36 37 43 77 87 88 89 109 111 240 255 278
Holcus 48 178 246
Holmes, E. M. 43
Homalia 59
Homalothecium 59
Hookeria : see Pterygophyllum
Hordeum 123 180 181 276
Hottonia ... 20 68 70 75 120 159 258
How, William 190
Hudson, Wm. 196
Hummel, Prof. J. J. ... 207 210
Humulus ... 75 120 163 242 252
Hunt, G. E. 87
Hunter, Edward ... 41 42 43
Hurst, J. S. 138
Hyalotheca 106
Hydnum 97 219
Hydrocharis 68 76 166
Hydrocotyle 49 142 234 276
Hydrocytium 106
Hygrophorus 26 96 208 215 216
Hylocomium... ... 24 61 66 67 80
Hymenochæte 97
Hymenophyllum 65 67 77 275 279
Hyocomium 36 69 80 92
Hyoscyamus... ... 119 153
Hypericum 5 6 10 19 30 33 70 73 133 134 229 255 275
Hypholoma ... 26 39 95 214 215
Hypnum 24 37 47 52 60 61 66 67 68 70 80 89 92 93 194
Hypochæris 149 237
Hypomyces 208 224
Hypoxylon 67 83 224
Hysterium 103

Ibbotson, Henry 123
Igneo-metamorphic Soils, Plants of 45
Ilex... ... ... 136 230
Ilkley, Notes from 11 16
Impatiens 230

BOTANICAL TRANSACTIONS

OF THE

YORKSHIRE NATURALISTS' UNION.

VOL. I.,

MISCELLANEOUS PAPERS, REPORTS AND PROCEEDINGS OF THE BOTANICAL SECTION, 1877—1891.

LEEDS :
PRINTED FOR THE YORKSHIRE NATURALISTS' UNION
BY TAYLOR BROTHERS.

1891.

PREFACE.

THE present volume has been in progress for more than a dozen years, and it is deemed advisable to bring it to a close by issuing a title-page and index. It forms the first volume of the Botanical Series of the Transactions, the second being the 'Flora of West Yorkshire,' by Mr. F. ARNOLD LEES, and the third, which is still in progress, the Second Edition of 'North Yorkshire,' by Mr. J. GILBERT BAKER.

The Reports and Proceedings of the Botanical Section, and such short Papers as have appeared in the present volume, will henceforth be printed in the pages of 'The Naturalist.'

PAGE
Ingleton, Notes from 64 72
Inocybe 214
Inula 4 20 75 268 272
Iris... ... ... 49 169 170 273
Isaria 101 222
Isothecium 59 79

Jackson, John
115 116 117 118 119 120 121
Jasione 48 69 151 238
Jessop, Francis 193
Johnson, Henry ... 120 121 123
Johnson, Thomas 189
Johnsonia 190 201
Juncus
6 18 32 48 49 171 172 243 244 276
Jungermania
24 37 38 62 63 66 67 69 80 93

Kantia 63
Knowlton, Thomas ... 195 198
Knowltonia 195
Kœleria 21

Lactarius 26 39 40 96 208 216 217 224
Lactuca ... 119 150 237 251
Lamium 22 75 157 158 240 241 260 267
Lapsana 149 237
Lathræa ... 20 69 75 155 240 267
Lathyrus 138 231 268
Lawson, Thomas 193
Lawsonia 193 201
Lecanora 25 46 66 82
Lecidea ... 25 46 49 66 67 68 82
Lecythea 27 222
Ledstone Park, Fungi at ... 207
Lee, P. F. 85 202 203 225 251 267 270
271 273 277 278 279 280
Lees, F. Arnold 1 3 9 29 30 31 32 36 39
43 44 85 86 87 88 91 92 93 94
109 110 111 112 114 115 116 117
118 119 120 121 123 129 131 137
145 146 150 153 155 156 158 159
160 161 162 163 164 166 169 170
173 174 175 176 177 180 182 203
204 205 251 252 254 255 256 257
261 263 270 274 277 278
Leighton, Rev. W. A.... ... 9 44
Lejeunia 38 93
Lemania 7 68 83
Lemna ... 12 70 76 120 165 244
Lentinus 40
Lenzites 40 218
Leontodon 149 237
Leonurus 157 260
Leotia 223
Lepidium 85 130 227 228
Lepidozia 24 63
Lepiota ... 39 95 208 210 211

PAGE
Lepista 96
Leptobryum 36 69 79 91
Leptothrix 105
Lepturus 6 32
Leskea 13 59 67
Leucobryum... ... 49 55 90
Leucodon 59
Ligustrum 152 238
Ley, Rev. A.... .. ...85 110
Limosella 31
Linaria ... 20 22 154 239 275
Lincolnshire Plants 44 52
Linnæa 118
Linnæus, Carolus 195
Linum 22 134 229 230
Lister, G. L.... ... ... 33 34
Lister, Martin 192
Lister, Thomas ... 208 314 219
Listera ... 169 192 201 243
Lithospermum ... 158 238 267
Littorella 160
Liverworts (Hepatics) of East Riding (R. Spruce) ... 62 63
Lobel 188
Lobelia 188
Lolium 49 180 247
Lomaria 181 247
Lonicera 145 235
Lophocolea 62 93
Lotus ... 115 137 206 231 272
Lunularia 63 94
Luzula 171 244 261
Lychnis 132 228
Lycium 22 239
Lycogala 27 83 98 221
Lycoperdon 98 221
Lycopodium 44 65 77 123
Lycopus 156 240
Lyngbya 105
Lysimachia ... 48 75 160 238 258 259
Lythrum 140

Mackenzie, J. 39 40
Madotheca 38 47 66 80 94
Malaxis 279
Malhamdale, Notes from ... 204
Malva ... 17 85 110 134 229 276
Marasmius 26 96 208 218
Marchantia 63
Marrubium 157
Massee, Geo. E. 85 86 89 90 91 92 93 94
95 96 97 98 99 100 101 102 103
104 111 123 202 207 208 209
Mastigobryum 38
Matricaria 147 236
Meconopsis 21 127
Medicago 136 230 255
Melampsora 70 83 100

PAGE
Melampyrum... ... 155 206 240
Melica ... 69 77 87 178 179 246
Melilotus 136 230
Melosira 41
Mentha ... 70 75 156 240 273
Menyanthes 119 152
Mercurialis 163 242 260
Meridion 28 41
Merulius 219
Mesocarpus 105
Metzgeria 38 63 66
Micrasterias 41
Milium 178 246
Mimulus 154
Mnium 4 23 36 58 65 67 79 91 92 194
Moiser, H. K. 1
Molinia 49 178
Monostroma 106
Montane Plants in the Plains 44
Montia 48 133 229
Morchella 8 27 267
Morton, Miss Rose 88 126 130 131 132 135 136 140 142 146 149 153 156 159 166 167 169 170 172 173 176 178 179 180 181
Moss-flora of East Riding (H. F. Parsons) ... 51
Mougeotia 69 71 84
Muckle, J. 218
Mucor 102
Murdoch, J. R. 93 117
Mutinus 27 98 221
Mycena 95 208 212 213
Mylia 62
Myosotis ...18 20 75 158 204 238 273
Myosurus 126
Myrica 49 76
Myrinia 59
Myriophyllum 17 70 74 140 141 257
Myrrhis 4 144 234

Narcissus 170 261
Nardia 62
Nardus 49 181 247
Narthecium 49
Nasturtium 129 226 227 254
Naturalist, The 43
Naucoria 214
Navicula 28 42 108
Neckera 23 47 52 59 66
Nectria 103 224
Neottia 34 169
Nepeta 156 240
Nephrodium 21 49 68 77 123 182 247 263 279
Nevile, J. 230 258
Newtondale, Notes from ... 272
Nicholson, George 123

PAGE
Nidderdale, Notes from ... 272
Nitella 123 248 252 264
Nitzschia 41 107
Nolanea 95 208 213
Nostell, Notes from 3
Nostoc 28 47 67 106
Nowell, J. 89
Nuphar 70 127
Nuttall, Wm. 86 91 93 104 106
Nyctalis 217
Odontia 219
Odontidium 107
Odontoschisma 62
Œdipodium 36
Œdogonium 105
Œnanthe ... 74 118 143 234 257
Œnothera 33 234
Oidium 102
Oligotrichum... 36
Omphalia 26 68 83 95
Ononis 48 136 230
Ophiocytium... 106
Ophioglossum 69 77 87 184 248
Ophrys 34 87 168
Orchis 6 17 47 76 86 167 168 243 268 272
Origanum 47 156
Ornithogalum 31 171
Ornithopus 10 48 137
Orobanche 155
Orobus 138
Orthothecium ... 36 66 92
Orthotrichum 23 52 56 57 65 66 78 79 88 91
Oscillatoria 40 67 69 84 105
Osmunda ... 68 77 183 248 276
Oxalis 135 230

Palmella 40
Palmoglœa 28
Paludella 37
Panæolus 26 95 215
Pandorina 40 69
Pannaria 25 82
Papaver ... 48 127 226 253 276
Parietaria 163 260
Paris 21 69 170 261
Parker, G. W. 259
Parkinson 190
Parmelia 4 13 25 39 46 66 67 81 82 94
Parnassia 142
Parsons, H. F. 1 2 9 29 30 31 32 33 34 35 36 37 38 40 41 43 50 53 62 63 64 85 88 109 110 232 251 260
Pastinaca 47
Paxillus 26 215
Peaty Soils, Plants of ... 49

PAGE
Pediastrum 41 107
Pedicularis 155 240 258
Peirson, Archdeacon ... 159 199
Pellia 38 63 94 110
Peltigera ... 7 25 39 67 81 94
Penicillum 101
Peniophora 220
Penium 41 84
Peplis 48
Percival, John 89
Perichæna 8
Peronospora 101 207 222
Pertusaria 82
Petasites 149 236
Peucedanum... ... ... 11 22
Peziza 8 27 40 49 83 102 207 208 223
Phalaris 177 245
Phallus 98 220
Phascum 49 54 55 57 89
Phelonitis 99
Phillips, W.... ... 9 207 208 210
Philonitis 23 57 91
Phlebia 220
Phleum 177 246
Pholiota 26 213 214
Phoma 99
Phragmidium 99
Phragmites 49 177
Physarum 221
Physcia 25 82 94
Physcomitrium ... 57 79 91
Picris 20 48 237
Pilobolus 207 222
Pilularia 5 6
Pimpinella ... 70 74 117 142 143 234
Pinguicula 49 159
Pinnularia 43 109
Pinus 76 164 243
Pistillaria 97
Placodium 25 47 82
Plagiochila 37 62 93
Plagiothecium 24 37 52 60 67 80 89 92
Plantago ... 10 12 20 48 160 241
Platysma 25 38 44 52 94
Pleuridium 54
Pleurococcus... 106
Pleurosigma 42 43
Pleurotænium 84
Pleurotus 95 208 213
Plowright, C. B. ... 207 208 210
Plues, Miss
130 152 153 154 159 165 170
Pluteus 213
Poa... ... 32 87 123 179 246
Pocklington, Notes from ... 268
Pogonatum 48 58 70 79 92
Polemonium 86 153 193
Polyactis 207 222
PAGE
Polygala ... 29 73 131 228 251 254
Polygonatum... 170
Polygonum 34 162 241 252
Polypodium ...34 69 77 123 183 263 269
Polyporus 26 40 67 83 96 97 208 218 219
Polystichum : see Aspidium
Polytrichum ... 5 36 48 49 52 58 65 79
Pontefract, Notes from ... 3 10 16
Populus ... 22 163 242 243 261
Potamogeton 20 31 32 86 120 165 244 262 276
Potentilla 10 19 22 30 33 70 74 85 117 139 232 233 273
Poterium 46 183 233
Pottia ... 35 52 55 70 78 87 90
Prasiola 8
Primula 11 14 20 75 86 159 205 238 267
Problems of Plant-distribution 43
Proceedings of the Botanical Section 1 2 9 111 124 202 270 278
Protococcus 109
Prunella 157 240
Prunus 19 74 117 138 231 251 255 267 273 279
Psalliota 26 214
Psamma 87
Psathyra 95
Psathyrella 215
Psilocybe 26 39 215
Pseudoleskea... ... ... 66 79
Pteris 181 247
Pterygophyllum ... 66 67 79 92
Ptilidium 63 66 93
Ptychogaster... 221
Ptychomitrium ... 23 35 45 78 91
Puccinia ...27 40 99 100 124 221 222
Pulicaria 236
Pylaisia 59 92
Pyrola ... 70 75 110 151 280
Pyrus 47 140 235 275

Quercus 4 163 242

Racomitrium 4 11 23 35 44 45 52 66 78 88
Radiola 48 79 134
Radula 63 66 93
Ræstelia: see Roestelia
Ramalina 24 81
Ranunculus 5 17 19 29 68 70 73 86 110 114 126 203 225 226 253
Raphanus 128 228
Raphidium 84
Ray, John 191
Reboulia 24 38 63 66 81
Reseda 19 46 130 228

PAGE

Reports of the Botanical Section (for 1877) 3 (1878) 10 (1879) 64 (1880) 112 (1883-84) 203 (1885) 267 (1886) 271 (1887) 273 (1888) 279

Reticularia 8 98
Rhacomitrium : see Racomitrium
Rhabdoweissia ... 66 78 110
Rhamnus ... 19 49 73 117 136
Rhinanthus 70 75 155 240
Rhynchospora ... 49 172 276
Rynchostegium .. 24 37 60 80 92
Rhytisma 68 83 207 223
Ribes ... 17 18 19 86 141 198 233
Riccall Common, Notes from ... 70 72
Riccia ... 38 63 69 71 81 94
Richardson, Richard ... 194 200
Richardsonia 194
Ridgway, F. W. 263
Ridley, H. N. 123
Ripon Florula (H. H. Slater) 125
Rivularia 28 105
Roberts, George ... 31 258 277
Robertson 201
Robinson, J. 33
Robson, Edward ... 191 198
Robson, Stephen 197
Roche Abbey, Notes from ... 205
Roebuck, Wm. Denison ... 207
Rœstelia 27 100
Rogers, T. 86 88 91 92
Rosa 19 30 31 33 85 139 140 206 233 269 277
Rubus 14 19 30 33 49 65 69 70 74 86 117 139 232 251 254 256 257 274 276 277 279
Rumex 34 48 75 85 161 162 241 260
Ruscus 26
Rushforth, William 226 227 228 239 243 248 252 253 255 258 261 262 263
Russula 22 96 217

Saccogyna 38
Saddleworth, Notes from ... 279
Sagina ...70 73 86 110 133 220 277
Sagittaria 76
Salicornia 206
Salisburia 201
Salisbury, R. A. ... 197 199
Salix 17 18 20 48 70 76 86 110 163 164 242 261 269
Saltburn, Notes from 273
Salvia 34 47 119 156
Sambucus 145
Samolus 20 120 160 235
Sanguisorba 138
Sanicula 142 234
Saponaria 33 131 228

PAGE

Saprolegnia 102
Sarothamnus 48 136 230
Saynor, Benj. 40
Saxifraga 11 14 19 47 65 67 74 142 275 279
Scabiosa .. 48 146 235 269 275
Scalia 63
Scandix 144 234
Scapania 24 62 67 93
Scenedesmus... ... 41 84 107
Scheuchzeria... 166
Schizogonium 106
Schizophyllum 40 218
Schœnus 28 121 172
Sciadium 106
Scilla 171 243
Scirpus 6 18 21 34 70 121 172 173 245 252
Scleranthus 48 133 276
Sclerochloa ... 6 21 47 123 179 181
Scleroderma 27 98 221
Scleropodium 59 89
Scolopendrium 47 182 263 273 275
Scorpiurus 33 231 252
Scrophularia... ... 153 154 239
Scutellaria ... 34 69 75 85 157 203 240
Scytonema 40
Sedbergh, Notes from 275
Sedum ... 11 22 31 33 117 141 233
Selaginella 34 65 77 184
Seligeria 35 54 66 78 90
Sempervivum ... 141 233
Senebiera 130
Senecio ... 148 237 237 252 258
Sepedonium 102
Serratula 68 204
Sesleria 21 65 76
Settle, Notes from 13 16
Sherardia 146 235
Sherburn, Notes from 205
Shipley, Notes from 3
Silaus 48 74 143 235
Silene 33 86 115 131 132 228 255
Silybum 146
Sinapis 21 114 128
Sirosiphon 84
Sison 11 20 33
Sisymbrium 128 227
Sium 6 31 33 143 205
Slater, Rev. H. H. ... 114 117 125 208
Slater, M. B. 38 53 54 55 56 57 58 59 60 61 62 63 116 118 202 270 278
Smith, Rev. G. E. 31 32
Smith, W. 221 259
Smyrnium 11
Soils, Classification of (Parsons) 45
Solanum 153 239
Solenia 220

PAGE

Solidago 149 235
Solorina 39 47 66 81 94
Sonchus ... 18 48 150 237 238 269
Soppitt, H. T. 74 86 87 95 96 97 98 99 100 101 102 103 104 111 124 208 210 212 213 215 216 217 218 219 220 223 242 258 270
Sparganium ... 76 164 244 261 262 280
Specularia 151
Spergula 48 116 133 229
Spergularia 6 48 229 276
Sphærangium 55
Sphæria 103 104 207 224
Sphærobolus 40
Sphærocarpus 63
Sphærophoron ... 38 66 69 81
Sphærotheca 102
Sphærozosma ... 41 71 84
Sphagnæcetis 92
Sphagnum 5 22 34 35 49 52 53 54 70 77 89 194
Sphenosira 108
Spiræa ... 46 117 138 232 272
Spiranthes 168
Spirogyra 8 71 84 104
Spirulina 105
Splachnum 36 66 91
Spurn, Notes from 206
Spruce, Dr. Richard 35 37 53 54 55 56 57 58 59 60 61 62 89
Squamaria 48 67 82
Stabler, Geo. 36 37 38 43
Stachys ... 120 157 240 259 272
Stansfield, T. 88
Staphylea 22
Staurastrum 41 84 107
Staurocarpus 105
Stauroneis 109
Stegia 68 83 103 223
Stellaria 19 67 68 70 73 115 116 132 133 229 255 268 272 276
Stemonitis 98
Stereocaulon 81
Stereum 27 83 97 220
Stevenson, Rev. J. 111
Stictina 81
Stigeoclonium 104
Stigmatea 104
Stilbum 101 222
Stratiotes 70 76 203 280
Strensall Common, Notes from ... 203
Stropharia 95 214
Stuart, J. A. Erskine 202 231 252 270 278
Suæda 206
Summerfield, Rev. R. A. 125 171 208
Surirella 41 107
Symphytum 120 158 159

PAGE

Synedra 41 108
Systegium 55

Tabellaria 41 84
Tacey, W. G. 40
Tamus 170 243
Tanacetum 147 236
Taraxacum ... 33 85 150 237 258
Targionia 38
Taxus 20 47 65 76 164
Taylor, A. P. 214
Taylor, E. 1
Taylor, Matthew 221
Teesdale, Robert; Plantæ Eboracenses 53 62 129 198 201
Teesdalia ... 10 19 48 129 199 201 254
Tetmemorus 107
Tetracyclus 109
Tetraphis 58 68
Tetraplodon 23 52 57
Tetraspora 106
Teucrium 48 158 241
Thalictrum 19 29 70 86 125
Thamnium 59
Thelephora 97 207 219
Thlaspi 19 86 129
Thoresby, Ralph 193
Thornton, R. 270
Thuidium 36 59 66 92
Thymus 47 156
Tilia 22 134 229
Tilletia 70 83
Tilmadoche 98
Tissiman, P. 118
Tofield 197
Tofieldia 197 201
Tolypella 123
Tolypothrix 105
Torilis 144
Torrubia 103
Tortula 45 47 52 55
Torula 99 207 221
Trachyspora 222
Tragopogon 149 238
Trametes 219
Tremella 97 98 220
Trichia ... 98 99 207 221 222
Trichobasis ... 27 70 83 100 222
Tricholoma ... 8 26 39 95 208 211
Trichomanes 194
Trichostomum ... 23 35 55
Trientalis 4 6 160
Trifolium 17 30 33 47 48 70 73 136 137 230 231 255
Triglochin 21 166
Triodia 178
Triphragmium 27
Trisetum 246

PAGE

Triticum 180
Trochila 224
Trollius 11 19 127
Tryblionella 41
Tubercularia 101 207
Tuburcinia 100
Turner, William ... 187 188
Turner, W. B.
41 104 105 106 107 108 109
Turnera 188
Turton, T. C. 40
Tussilago ... ... 4[illegible] 110 236
Tute, Rev. J. S.
105 106 107 108 109 141
Tyndaridea 8
Typha 18 20 70 76 120 164 244 252 275
Typhula 97 220

Ulex ... 70 73 136 230 251
Ulmus 76 86 163 242
Ulota 56 65 67 78 88
Ulothrix 104
Ulva 40 48
Umbilicaria 67 82
Uredo ... 68 69 70 83 100 222
Urocystis 100
Uromyces 100
Urtica 163 242
Usnea 66 81
Ustilago 100
Ustulina 103 224
Utricularia 68 70 120 159

Vaccinium 4 5 11 20 34 47 49 67 69 75
119 151 238 272
Valeriana 146 235
Valerianella 146 235
Valsa 224
Vaucheria 84 105
Verbascum 31 47 153
Verbena 75 119 156
Vermicularia 99
Veronica 18 119 154 155 239 272 274
Verrucaria 25
Vibrissea 8
Viburnum 145 235
Vicia ...68 73 74 137 138 231 268
Vinca 22 152
Viola 4 19 29 46 73 85 130 131 205 228
Viscum 144

PAGE

Vize, Rev. J. E.
207 208 210 221 222 223 224
Volvox 40 69

Wahlenbergia 49
Wainwright, Joseph 1
Washburndale, Notes from 204 268 269
Watson, Hewett Cottrell ... 112
Webera 56 67 79 88 91
Webster, Geo. 1 29 30 33 36 110 111 117
Weissia 48 54 87 110
Welton Vale, Notes from ... 276
Wensleydale, Notes from 205 279
Wentbridge, Notes from ... 16
Wesley, J. S. 30 35 37 43 88 89 90 92
109 110 119 120
West, Tuffen 9
West William 9 29 30 31 32 33 34 35 36
37 38 39 40 41 43 50 64 74 85 86
87 88 89 90 91 92 93 94 95 96 97
98 99 101 102 103 104 105 106
107 108 109 110 111 114 116 117
210 211 212 213 214 215 216 217
218 219 220 221 222 223 224
Wetherby, Notes from 3
Wharncliffe, Notes from ... 14 16
Whitby, Notes from 268
Whitehead, J.
30 35 43 87 88 89 91 92 93 109
Whitwell, W. 115
Williamson, W. C. 124
Willisel, Thomas 192
Wilson, C. J. 242
Wilson, John 196
Wilson, J. E. 106
Winch, N. 151
Wood, Dr. 88
Wood, Rev. Wm. 197
Woodd, Trevor Basil 280

Xanthium 85 236 260
Xylaria 27 103 207 224

Younge, Wm. 197

Zannichellia ... 12 18 21 32 165 244 252
Zasmidium 221
Zieria 23 36 66 79
Zygnema 104
Zygodon 36 56 91
Zygogonium 105

TAYLOR BROTHERS, PRINTERS, LEEDS.

Museum of Comparative Zoology
OCT 11 1945
LIBRARY

METEOROLOGY OF BRADFORD FOR 1888.

YEARLY MAXIMUM AND MINIMUM ATMOSPHERIC PRESSURE, TEMPERATURE, HUMIDITY, BRIGHT SUNSHINE, WIND PRESSURE, AND RAINFALL.

Year.	Pressure. Highest: Reading of Barom. during Year	Pressure. Highest: Date	Pressure. Lowest: Reading of Barom. during Year	Pressure. Lowest: Date	Temperature. In Shade. Highest: Reading of Maximum Thermom. during Yr.	Temperature. In Shade. Highest: Date.	Temperature. In Shade. Lowest: Reading of Minimum Thermom. during Yr.	Temperature. In Shade. Lowest: Date	Temperature. Last and First Frost of Seasons: Date of Last Frost	Temperature. Last and First Frost of Seasons: Date of First Frost	Temperature. In Sun's Rays. Highest: Reading of Solar Thermom. during Yr.	Humidity (Complete Saturation = 100.). Highest: Degree of Humidity during Yr.	Humidity (Complete Saturation = 100.). Highest: Date.	Humidity (Complete Saturation = 100.). Lowest: Degree of Humidity during Yr.	Humidity (Complete Saturation = 100.). Lowest: Date	Bright Sunshine. Greatest Duration	Bright Sunshine. Date	Bright Sunshine. Total of Year.	Bright Sunshine. Per cent. of Possible Duration	Wind Pressure. Highest	Wind Pressure. Date	Wind Pressure. Total for Year	Rain. Mean Yrly Rainfall from 1841 to 1887 inclusive	Rain. Greatest Rainfall in 24 hours during Yr.	Rain. Date	Rain. Out-Townships at Tn Hill & Midland Stn thereabouts & adjacent at Exchge. Depth in Inches	Rain. Out-Townships at Tn Hill & Midland Stn thereabouts & adjacent at Exchge. Percentage of Fall at Exchange	Rain. Greatest Fall in 24 hours during Yr.	Rain. Snow. Date	Rain. Snow. Last and First Snow of Season. Date of Last Snow	Rain. Snow. Last and First Snow of Season. Date of First Snow.
	Ins.		Ins.		Deg.		Deg.				Deg.	0—100		0—100		hr. min.		hr. min.		lbs. per sq. ft.			Ins.	Ins.		Ins.	Per cent	Ins.			
1869	30 250	Dec. 6	28 500	Feb. 1	85	Aug. 30	19 8	Dec. 28	Mar. 27	Oct. 20	127·7	Aug. 30	89	Feb. 5	42	Sep. 24												April 3	Oct. 19
1870	30 294	Jan. 19	28 508	Jan. 8	85	July 25	16 6	Dec. 23	Mar. 30	Nov. 9	127·5	July 25	89	Jan. 29	40	July 14												Mar. 24	Nov. 15
1871	30 152	Mar. 28	28 308	Jan. 16	84	June 12	16 7	Jan. 1	April 11	Nov. 13	128·7	July 17	88	July 7	43	Nov. 2												June 16	Mar. 15
1872	30 166	April 6	28 070	Jan. 24	86	July 23	24 8	Mar. 27	Mar. 27	Nov. 19	124 8	Aug. 10	100	Mar. 22	45	Sep. 23												June 13	May 31
1873	30 338	Feb. 18	28 022	Jan. 20	86	July 23	14 2	Feb. 24	Mar. 14	Nov. 5	124·5	July 23	100	Dec. 11	41	Mar. 26												Aug. 4	April 25
1874	30 476	Mar. 6	28 276	Dec. 11	80	July 20	15 0	Dec. 31	Mar. 12	Nov. 11	125 8	July 20	100	Feb. 6	49	May 18												Mar. 9	Nov. 28
1875	30 305	July 7	28 484	Nov. 10	80	Aug. 17	13 0	Jan. 1	Mar. 22	Nov. 26	122·0	July 5	100	Jan. 24	43	July 6												Nov. 5	Mar. 12
1876	30 300	Jan. 15	28 070	Dec. 4	87	July 17	23 0	Jan. 1	May 4	Oct. 18	129·0	July 16	99	Oct. 4	46	May 5												Oct. 9	April 12
1877	30 326	Oct. 6	28 300	Nov. 29	80	June 19	20 0	May 1	May 4	Oct. 18	116 4	June 19	100	Oct. 29	56	May 24												July 16	May 14
1878	30 320	Mar. 16	28 630	April 1	89	July 19	13 9	Dec. 26	April 6	Nov. 9	118 2	July 22	99	Jan. 13	53	Aug. 9												Aug. 14	April 1
1879	30 357	Dec. 13	28 500	Feb. 10	74	July 30	13 2	Dec. 7	May 10	Nov. 14	101 2	Aug. 13	100	Oct. 7	51	Dec. 12												June 8	May 7
1880	30 352	Jan. 7	28 154	Nov. 16	89	Sep. 5	20 8	Jan. 20	Feb. 23	Oct. 20	132 0	Aug. 13	99	Dec. 15	50	May 30												Mar. 27	Oct. 27
1881	30 362	May 10	28 050	Oct. 14	83	July 6	12 0	Jan. 26	April 21	Oct. 17	116 5	June 1	98	Oct. 14	48	May 31												April 20	Oct. 24
1882	30 544	Jan. 18	28 452	Mar. 1	77	Aug. 12	18 6	Dec. 11	April 15	Nov. 12	108 0	Aug. 9	93	Nov. 5	36	May 15												May 21	Nov. 12
1883	30 500	April 9	28 452	Sep. 2	76	July 3	19 8	Mar. 10	Mar. 29	Nov. 12	107 6	May 17	89	Dec. 26	30	April 9												Sep. 26	Mar. 21
1884	30 554	Oct. 5	28 576	Jan. 27	84	Aug. 12	26 5	Nov. 30	April 24	Nov. 24	107 8	Aug. 9	80	Jan. 23	33	May 22												Jan. 17	Feb. 26
1885	30 273	Mar. 14	28 400	Jan. 11	82	July 27	22 1	Dec. 11	April 5	Nov. 16	113 6	July 27	100	Jan. 23	32	June 5												Jan. 7	Dec. 9
1886	30 325	Nov. 24	27 652	Dec. 8	78	Jun 3	17 4	Mar. 7	April 30	Dec. 2	109 8	July 5	99	Jan. 12	32	May 4	11 45	July 6	851 43	14	18 00	Dec. 9	45 993					May 17	May 6
1887	30 412	Feb. 3	28 328	Nov. 3	82	July 9	21 1	Jan. 17	April 17	Dec. 19	116 6	July 9	100	April 21	35	July 9	13 40	July 3	1127 58	25	15 00	Feb. 4	48 665					Oct. 9	May 21
1888	30 333	Jan. 10	28 410	Mar. 28	80	June 27	19 2	Feb. 14	April 8	Oct. 2	110 0	Sep. 15	99	Mar. 15	29	June 11	13 40	May 24	984 20	20	13 00	Mar. 4	55 676					Nov. 3	April 8
Means	30 341		28 397		82		18 1				116 7		96		40		12 42		952 49	21	17 05		50 597	33 00	3 670	11 08	1 361			

EXPLANATION.

a.m., and, with the exception of maximum and t at three p.m.

eadings for each month, also the monthly range, pressure is deduced from bi-daily observations mperature, and diurnal range. To correct for temperature being 48 degrees and barometer the heights given

ne depression occurred on the 8th December, the Exchange barometer had fallen to 27 466 rd here. The cyclone indicated by this depres- and property, extending over an unusually

deductions are given in degrees Fahrenheit f air is deduced from the dry bulb and the temperature of evaporation from the dry and mum readings. The dew point, elastic force ed from bi-daily readings of the dry and wet netrical Tables, sixth edition.

The sunshine is recorded in hours and minutes by glass sphere on cards fixed on Professor Stokes' zodiacal frame.

The solar thermometer has a black bulb enclosed in a vacuum

The direction, velocity, and pressure of wind are recorded as indicated by anemometers fixed 10½ feet above the ridge of roof of Exchange. The velocity per hour at 9 a.m. is determined from anemometer readings made one minute and a half before and a like period after that hour, by multiplying the difference thereof by 20. The pressure is given in pounds avoirdupois per square foot.

The amount of cloud is estimated by a scale ranging from 0 to 10.

The rain gauge is fixed upon the top of central roof of the Exchange, at an elevation of 65½ feet above the surface of the ground and 59½ feet above mean sea level. As rain gauges on the summit of buildings are generally found to collect less rain than when placed upon the surface of open ground adjacent thereto, steps were taken in 1875 to determine to what extent this was the case with the Exchange rain gauge, when two additional gauges were provided and fixed upon the surface of adjacent open spaces, one near to the Town Hall, the other near to the Midland Railway Station, between which the Exchange gauge is situate about midway, and the surface of ground about the same height. At both of these gauges, as well as at the Exchange gauge, daily observations were made from the commencement of 1876 to the end of 1882, a period of seven years, when the surface gauges were removed in consequence of the ground they occupied being no longer available for the purpose. The particulars of these gaugings are set forth in tables. The results show that the mean yearly rainfall on the surface of ground for the seven years ending with 1882 is 3·66 inches, or 11·08 per cent., greater than at the summit of the Exchange. The mean yearly rainfall recorded at the Exchange for the nineteen years ending with 1888 is 20·597 inches. By adding 11·08 per cent. thereto the mean normal rainfall of central Bradford for such period is found to be 33·987 inches per annum. There are good grounds for concluding that the smaller amount of rainfall collected on the Exchange—and on buildings generally—than on the surface of ground is due to the varying direction and force of wind there producing different currents and eddies, which prevent due precipitation on the top or ridge of roof where the gauges is fixed. The rainfall in 1869 was collected by a range placed on the ridge of outer roof of Exchange, near to the north-west corner thereof. This position not being deemed quite satisfactory, the gauge was removed at the end of that year to the ridge of central roof—the place it has since occupied. To avoid risk of inaccurate results, the rainfall of 1869 is omitted from these returns.

The instruments with which the observations are made have been verified by comparison with the standards at Kew Observatory.

80424

OCT 11 1945
LIBRARY

METEOROLOGY OF BRADFORD FOR 1888.

SHEET 1.

Computed from daily observations made at the Exchange, Bradford, by John McLandsborough, F.R.A.S., F.R.Met.Soc., F.G.S., and Alfred Eley Preston, Assoc. M. Inst. C.E., F.R.Met.Soc., F.G.S.
Latitude, 53deg. 47min. 38sec. N.; longitude, 1deg. 45min. 4sec. W. Height above mean sea level, 366ft.

Pressure of Atmosphere in Month.

Months.	Highest Reading of Barometer.	Date.	Mean of Highest of 20 Years.	Lowest Reading of Barometer.	Date.	Mean of Lowest of 20 Years.	Range.	Corrected for Capillarity and Temperature: Mean.	Corrected: Mean of 20 Years.
	Ins.	On	Ins.	Ins.	On	Ins.	Ins.	Ins.	Ins.
January	30·333	10th	30·174	28·816	31st	28·686	1·517	29·767	29·516
February	30·141	28th	30·081	29·089	12th	28·782	1·052	29·632	29·504
March	30·014	1st	[illegible]	28·410	28th	28·787	1·634	29·194	29·497
April	29·937	6th	30·077	29·152	18th	28·830	0·785	29·474	29·479
May	30·198	23rd	30·066	28·842	1st	29·021	1·356	29·585	29·555
June	29·976	23rd	30·006	29·185	29th	29·166	0·791	29·537	29·556
July	29·762	13th	29·965	29·016	3rd	29·159	0·752	29·320	29·511
August	29·964	18th	29·985	29·246	24th	29·077	0·718	29·562	29·513
September	30·199	13th	30·083	29·404	29th	28·965	0·795	29·771	29·508
October	30·159	21st	30·126	28·896	2nd	28·741	1·263	29·679	29·460
November	29·764	6th	30·028	28·618	27th	28·665	1·086	29·320	29·431
December	30·102	16th	30·101	28·689	22nd	28·657	1·413	29·501	29·468
Means, or totals	30·043		30·069	28·946		28·877	1·097	[illegible]	29·499

Temperature of Air in Shade during Month.

Months.	In Each Month: Highest	Date.	Mean of Highest of 20 Years.	Lowest.	Date.	Mean of Lowest of 20 Years.	Range.	Daily Mean in Each Month: Of all Highest	Mean of 20 Years	Of all Lowest	Mean of 20 Years	Range: Mean	Range: Mean of 20 Years	Of Dry Bulb: Mean	Of Dry Bulb: Mean of 20 Years
	Deg.	On	Deg.	Deg.	On	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
January	55·2	11th	52·9	26·1	20th	23·6	29·1	43·5	42·9	35·5	34·3	8·0	8·6	39·3	39·1
February	49·8	7th	53·5	19·2	14th	26·4	30·6	39·8	44·3	32·7	35·4	7·1	8·9	35·7	39·8
March	54·2	10th	56·8	26·6	2nd	25·9	27·6	41·5	46·4	33·0	35·3	8·5	11·1	36·9	40·4
April	60·2	15th	64·4	30·4	8th	31·2	29·8	47·9	52·8	[illegible]	39·5	9·6	13·2	42·4	44·8
May	76·6	20th	70·0	37·0	9th	34·7	39·6	59·5	58·2	44·4	43·6	15·1	14·6	50·4	49·3
June	80·4	27th	77·4	[illegible]	5th	41·6	40·4	61·7	65·0	48·5	50·0	13·2	15·1	53·3	55·7
July	70·2	26th	80·1	42·0	11th	46·4	28·2	61·3	68·5	[illegible]	55·9	10·2	14·6	[illegible]	60·2
August	75·7	10th	78·6	44·0	1st	45·4	31·7	63·0	67·5	51·7	53·1	11·3	14·2	56·4	58·9
September	66·6	3rd	73·4	41·0	30th	39·9	25·6	59·8	61·9	[illegible]	49·4	10·7	12·4	53·8	54·4
October	64·0	28th	63·5	29·1	2nd	32·5	34·9	52·4	53·8	41·6	43·2	10·8	10·6	47·1	48·2
November	58·4	17th	56·4	34·9	28th	28·7	23·5	49·3	47·2	[illegible]	38·2	9·4	9·0	44·8	42·7
December	57·8	6th	53·0	26·2	14th	23·4	31·6	46·5	42·8	37·5	34·3	9·0	8·4	42·4	39·2
Means, or totals	64·1		64·8	33·0		33·3	31·1	52·2	54·2	42·0	42·5	10·2	11·7	46·5	47·7

Adopted Mean Temperature and Vapour.

Months.	Adopted Mean Temperature: Of Air: Mean	Of Air: Mean of 20 Years	Of Evaporation: Mean	Of Evaporation: Mean of 20 Years	Dew Point: Mean	Dew Point: Mean of 20 Years	Vapour: Elastic Force: Mean	Elastic Force: Mean of 20 Years	In a Cubic Foot of Air: Mean	Mean of 20 Years	Short of Saturation	Mean of 20 Years	Mean Weight of a Cubic Foot of Air	Mean of 20 Years
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Ins.	Ins.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.
January	39·5	38·7	37·6	37·0	35·2	34·7	206	203	2·4	2·4	0·5	0·4	553	549
February	35·7	39·6	34·0	37·9	31·4	35·6	178	210	2·0	2·4	0·4	0·4	554	548
March	36·5	40·0	34·4	37·7	31·3	34·8	177	203	2·0	2·4	0·5	0·5	545	547
April	42·0	44·8	38·8	41·4	34·9	37·5	204	[illegible]	2·4	2·6	0·7	0·8	544	541
May	50·3	49·2	45·3	44·9	40·1	40·8	248	256	2·8	2·9	1·3	1·1	537	537
June	53·3	55·6	50·0	51·1	46·7	46·7	318	320	3·6	3·6	1·0	1·4	533	531
July	54·7	60·0	51·4	54·4	48·2	50·2	337	365	3·8	4·1	1·0	1·7	527	526
August	56·0	58·7	52·2	54·0	48·6	50·2	345	364	3·9	4·1	1·1	1·5	530	527
September	53·5	54·6	50·4	51·2	47·4	47·9	326	335	3·7	3·8	0·9	1·0	537	531
October	46·6	47·8	44·0	45·5	41·0	42·6	258	275	3·0	3·1	0·7	0·6	541	533
November	44·5	42·4	42·5	40·2	40·2	37·3	249	224	2·9	2·6	0·5	0·5	[illegible]	543
December	42·2	38·8	40·0	36·8	37·2	34·3	223	206	2·6	2·3	0·5	0·5	545	543
Means, or totals	46·2	47·5	43·4	44·4	40·2	41·0	256	265	2·9	3·0	0·8	0·9	540	[illegible]

Degree of Humidity. Complete Saturation = 100.

Months.	Highest	Date	Mean of Highest of 20 Years	Lowest	Date	Mean of Lowest of 20 Years	Mean.	Mean of 20 Years
	0—100	On	0—100	0—100	On	0—100	0—100	0—100
January	97	11th	97	61	26th	67	86	86
February	96	25th	97	63	24th	67	84	86
March	99	15th	96	57	21st	57	82	83
April	92	21st	94	[illegible]	16th	53	77	77
May	[illegible]	3rd	[illegible]	41	23rd	44	68	73
June	96	6th	[illegible]	39	11th	45	78	72
July	97	16th	91	43	27th	49	78	70
August	93	11th	92	52	31st	51	76	74
September	95	24th	96	56	6th	56	74	79
October	99	18th	97	58	23rd	62	82	83
November	98	27th	96	65	6th	[illegible]	[illegible]	83
December	98	27th	97	60	20th	66	84	84
Means, or totals	[illegible]		95	54		57	80	79

Bright Sunshine. Temperature of Air in Sun's Rays.

Months	Bright Sunshine: Greatest Daily Duration	Date	Total of Month	Per cent of Possible Duration	Temperature of Air in Sun's Rays: Highest	Date	Mean of Highest of 20 Years	Mean	Mean of 20 Years
	hr. min.	On	hr. min.		Deg.	On	Deg.	Deg.	Deg.
January	4 20	19th	14 50	6	62·2	27th	60·7	55·9	48·5
February	6 5	11th	49 55	18	71·8	10th	72·1	57·8	53·4
March	7 0	6th	69 40	19	72·8	22nd	83·0	61·7	62·0
April	8 50	2nd	76 35	18	84·6	15th	96·1	67·9	72·8
May	13 40	24th	[illegible]	33	100·0	20th	104·1	83·2	81·0
June	13 30	24th	123 0	24	105·0	26th	110·6	86·7	87·7
July	10 20	20th	86 30	17	102·0	20th	113·1	82·6	91·7
August	9 0	15th	100 25	[illegible]	96·0	9th	109·8	81·6	89·1
September	8 5	7th	90 0	24	110·0	15th	99·8	[illegible]	80·9
October	8 30	7th	72 55	22	96·6	8th	86·7	81·3	67·7
November	6 30	1st	22 15	9	87·6	1st	72·2	[illegible]	[illegible]
December	4 50	10th	16 10	7	71·7	7th	58·4	62·8	47·8
Means, or totals	8 23		[illegible]	20	68·4		88·9	[illegible]	69·9

Wind.

Months	Direction: Relative Proportion of at 9 a.m.: N.	NE.	E.	SE.	S.	SW.	W.	NW.	Velocity: At 9 a.m.: Mean	At 9 a.m.: Highest	At 9 a.m.: Date	During 24 hours: Mean	During 24 hours: Highest	During 24 hours: Date	Total Registered in Month
	No.	No.	No.	No.	No.	No.	No.	No.	Miles p. h.	Miles p. h.	On	Miles per d.	Miles per d.	On	Miles
January	4	2	2	5	3	3	5	7	[illegible]	12·0	7th	150	357	26th	4636
February	4	11	2	0	0	1	3	8	7·5	17·4	5th	189	258	20th	5488
March	3	8	2	5	0	3	5	5	9·2	18·4	9th	177	316	9th	5501
April	6	6	0	3	1	4	6	4	8·5	15·0	30th	167	265	24th	4997
May	4	3	2	3	6	3	7	3	[illegible]	26·0	3rd	173	376	3rd	5348
June	5	4	5	7	2	0	5	2	[illegible]	12·2	[illegible]	[illegible]	246	1st	4764
July	3	10	1	5	1	4	6	1	[illegible]	17·3	3rd	[illegible]	242	3rd	4221
August	4	4	3	2	3	4	10	1	[illegible]	12·6	13th	125	138	14th	3881
September	4	5	3	5	1	[illegible]	5	4	5·7	11·0	6th	125	219	7th	3741
October	7	1	0	3	2	6	10	2	6·5	17·4	28th	148	[illegible]	28th	[illegible]
November	[illegible]	2	8	5	[illegible]	6	7	[illegible]	[illegible]	26·7	24th	[illegible]	490	25th	[illegible]
December	7	1	0	2	9	4	2	6	5·8	14·2	3rd	[illegible]	[illegible]	4th	4517
Means, or totals	51	57	28	45	30	41	[illegible]	[illegible]	7·4	16·7		163	312		[illegible]

Wind Pressure. Cloud. Rain.

Months	Pressure: Mean of all Daily Highest	Mean of all Daily Highest of 5 Years	Highest	Direction	Date	Mean of Highest of Month of 5 Years	Mean Amount of Cloud	Number of Days it fell	Amount Collected	Greatest Daily Fall	Date	Mean of 19 Years	Mean of Seven Years ending with 1882, 6ft. above surface of ground	Mean of 7 Yrs. ending with 1882 at Tn. Hall and Mid. Ry. Station on surface of ground	Gutter fall on surface at Town Hall & Mid. Stn. than at 65ft. above surface at Exch.: Depth in Inches	Percentage of fall at Exch'ge
	lb. per sq. ft.	lb. per sq. ft.	lb. per sq. ft.		On	lb. per sq. ft.	0—10	No.	Ins.	Ins.	On	Ins.	Ins.	Ins.	Ins.	Per cent.
January	1·76	3·31	11·00	W	26th	13·05	8·6	13	0·79	0·19	26th	[illegible]	2·209	2·474	0·265	11·2
February	1·73	2·88	4·75	W	6th	10·15	8·2	15	1·00	0·32	20th	1·90	2·609	2·972	0·363	11·4
March	1·79	2·27	6·75	W	8th	10·95	7·5	20	3·35	0·55	12th	2·24	2·776	3·260	0·484	11·7
April	1·92	2·61	4·50	W	14th	9·65	8·0	17	2·40	0·58	21st	2·10	2·516	2·835	0·319	11·2
May	2·70	2·60	13·00	W S W	4th	9·76	6·3	8	0·79	0·33	30th	1·74	2·103	2·277	0·174	10·8
June	1·67	1·77	11·50	W	1st	8·05	7·7	13	2·52	0·82	10th	2·39	2·837	3·011	0·174	10·6
July	1·79	1·76	7·50	W	4th	6·30	7·4	19	4·12	0·94	3rd	3·03	3·401	3·641	0·240	10·7
August	1·40	1·70	4·75	W	14th	7·05	7·2	19	1·82	0·86	29th	2·49	3·654	3·892	0·238	10·7
September	0·96	2·10	5·50	S W	7th	7·05	7·2	10	0·42	0·16	30th	2·80	2·894	3·229	0·335	11·2
October	1·32	2·57	5·50	S W	29th	9·75	7·8	8	0·69	0·25	2nd	3·52	3·640	4·012	0·372	11·0
November	4·60	2·70	12·00	W S W	18th	11·12	8·5	26	6·35	1·05	3rd	3·00	3·421	3·828	0·407	11·2
December	1·55	3·16	6·25	S S W	4th	12·50	8·6	14	1·40	0·68	28th	2·71	3·681	4·170	0·489	11·3
Means, or totals	1·92	2·46	7·75			9·56	7·8	182	25·65	0·56		30·60	35·741	39·601	3·860	11·08

OCT 11 1945
LIBRARY

80424

METEOROLOGY OF BRADFORD FOR 1889.

SHEET 1.

Computed from daily observations made at the Exchange, Bradford, by John McLandsborough, M. Inst. C.E. retired., F.R.A.S., F.R.Met.Soc., F.G.S., and Alfred Eley Preston, M. Inst. C.E., F.R.Met.Soc., F.G.S.
Latitude, 53deg. 47min. 38sec. N.; longitude, 1deg. 45min. 4sec. W. Height above mean sea level, 366ft.

Pressure of Atmosphere in Month.

Months.	Highest Reading of Barometer.	Date	Mean of Highest of 21 Years.	Lowest Reading of Barometer	Date.	Mean of Lowest of 21 Years.	Range.	Corrected for Capillarity and Temperature. Mean.	Mean of 21 Years
	Ins	On	Ins.	Ins	On	Ins.	Ins.	Ins.	Ins
January	30 336	3rd	30 181	28 896	9th	28 696	1 449	29 687	29 524
February	30·025	19th	30 079	28 728	3rd	28 779	1·297	29·482	29 502
March	30 235	15th	30 157	28 460	20th	28 771	1·775	29·538	29·499
April	29 824	19th	30 0[illegible]5	28·815	4th	28·829	1·009	29 329	29·472
May	29·852	20th	30 056	29 234	28th	29·031	0·618	29·431	29 549
June	30·180	5th	30 014	29 4[illegible]8	2nd	29 178	0 752	29 683	29 562
July	30 134	1st	29 973	29·120	25th	29·150	1·014	29 530	29·512
August	29·914	31st	29 982	28·802	20th	29·063	1·112	29 421	29 508
September	30 120	15th	30 085	29·220	20th	28·977	0 903	29 614	29·513
October	29 979	25th	30 119	28 483	7th	28·729	1·496	29 280	29 457
November	30 322	17th	30 042	29 035	25th	28 683	1·287	29 772	29 446
December	30 358	5th	30 114	28 857	10th	28·666	1 501	29 718	29 470
Means, or totals	30 106		30·070	28 923		28·879	1·183	29 539	29 500

Temperature of Air in Shade during Month.

Months.	In Each Month. Highest.	Date.	Mean of Highest of 21 Years.	Lowest.	Date	Mean of Lowest of 21 Years	Range.
	Deg.	On	Deg.	Deg	On	Deg	Deg.
January	52 5	19th	52·9	28 4	1st	23 9	24 1
February	53 8	19th	53 6	24 6	10th	26 3	29 2
March	57 8	30th	56 9	21·3	4th	25 7	36 5
April	58 2	19th	64·1	33 8	18th	31 3	24 4
May	77·0	23rd	70·3	42 6	3rd	35 1	34 4
June	76 2	27th	77·4	47 0	11th	41 9	29 2
July	75·5	7th	79·9	45 8	24th	46 4	29 7
August	77 5	1st	78 5	45 0	20th	45 3	2 5
September	71·4	11th	70 4	36 5	22nd	33 8	4 9
October	55 8	16th	63 1	35 4	11th	32 6	20 4
November	57 0	8th	56 4	27·2	27th	28·7	29 8
December	52 0	18th	53 0	28 0	29th	23 6	24 0
Means, or totals	63·7		64 7	34 6		33 4	29 1

Months.	Daily Mean. In Each Month. Of all Highest	Mean of 21 Years.	Of all Lowest	Mean of 21 Years.	Range. Mean.	Mean of 21 Years.	Of Dry Bulb. Mean.	Mean of 21 Years	Adopted Mean Temperature. Of Air. Mean.	Mean of 21 Years	Of Evaporation. Mean	Mean of 21 Years.	Dew Point. Mean	Mean of 21 Years
	Deg	Deg	Deg	Deg	Deg	Deg	Deg.	Deg	Deg	Deg	Deg	Deg	Deg	Deg
January	43 6	42 9	35 9	34 3	7 9	8 6	40 9	39·2	40·3	38·8	38·8	37 1	36·9	34·8
February	42 9	44 2	35 5	35 3	9 4	8 9	37 8	39·7	37·8	39 5	36 0	37 8	33 6	35 5
March	45 1	46 3	34 3	35 2	11 1	11·1	39·6	40 3	39·3	40·0	36·8	37 7	33·6	34·7
April	49 3	52 6	34 1	39 5	10·2	13·1	43·4	44·7	43·0	44 7	40 1	41 4	36 6	37 5
May	61 5	58 3	48 5	43 6	13 0	14·5	54·1	49·6	53·7	49·4	49 8	45 2	46 0	41·0
June	68 3	65 2	52 2	50 1	16 1	15·1	59·4	55 8	59·0	55 8	53 5	51 2	49 2	46 8
July	65 9	68 3	52 6	55 8	13 3	14 5	56·8	60·1	58·2	59 9	57 7	54 3	47 7	50 1
August	61 4	67 2	53 0	53 1	11·4	14·1	57·8	58·9	57·4	58·7	53·4	54 0	49·3	50 1
September	61 3	61 8	50 [illegible]	49 5	10 2	12 3	5[illegible] 2	54 5	54·6	54 6	50·8	51 2	47 2	47·9
October	51 2	53 7	42 2	43 2	9 0	10·6	46·8	48·1	46·3	47 8	44 7	45 4	42 9	42 7
November	49·0	47 3	41 3	38 4	7·7	8 9	44 7	42 8	44·8	42·5	42 3	40 3	39 4	37 4
December	43 3	42 8	35 2	34 4	8 1	8·4	40·2	39 2	39 7	38 9	37 7	36 9	35 1	34 4
Means, or totals	53 8	54 2	43 2	42 5	10 6	11 7	48 2	47 8	47 8	47 5	44 7	44·4	41 4	41·1

Vapour.

Months.	Elastic Force. Mean	Mean of 21 Years.	In a Cubic Foot of Air. Mean	Mean of 21 Years.	Short of Saturation	Mean of 21 Years.	Mean Weight of a Cubic Foot of Air	Mean of 21 Years.
	Ins.	Ins	Grs	Grs.	Grs	Grs	Grs	Grs
January	219	204	2 5	2 4	0 4	0 4	550	549
February	192	209	2 2	2 4	0 5	0 4	549	548
March	193	202	2 2	2 3	0 6	0 5	550	547
April	217	227	2 5	2 6	0 7	0 8	510	541
May	·310	259	3 5	3 0	1 2	1 1	531	537
June	·337	321	3 8	3 6	1 8	1 4	529	531
July	331	363	3 7	4 1	1·7	1 7	528	526
August	357	364	4 0	4 1	1 3	1 6	526	527
September	·324	335	3 7	3 8	1·1	1 0	533	531
October	·[illegible]77	275	3 2	3 1	0 5	0 6	536	537
November	·241	·25	2 8	2 6	0 6	0 5	547	543
December	205	200	2 4	2 3	0 5	0 5	552	548
Means, or totals	·267	265	3 0	3 0	0·9	0·9	539	539

Months.	Degree of Humidity. (Complete Saturation = 100.) Highest	Date	Mean of Highest of 21 Years	Lowest	Date.	Mean of Lowest of 21 Years	Mean	Mean of 21 Years
	0 100	On	0 100	0 100	On	0 -100	0—100	0 100
January	98	19th	97	64	29th	67	88	86
February	98	28th	97	48	10th	66	85	86
March	98	4th	96	56	29th	57	81	83
April	99	22nd	94	53	24th	53	79	77
May	98	24th	92	46	2nd	45	75	73
June	89	[illegible]	93	39	26th	48	68	72
July	86	2[illegible]th	91	41	11th	48	69	70
August	93	21st	92	48	8th	51	75	7[illegible]
September	93	18th	95	47	18th	55	76	78
October	99	10th	97	62	9th	62	89	83
November	94	13th	96	58	26th	63	82	83
December	97	24th	97	52	2nd	65	84	84
Means, or totals	95		95	51		57	79	79

Bright Sunshine. — Temp. of Air in Sun's Rays. — Wind: Direction.

Months	Bright Sunshine. Greatest Daily Duration.	Date.	Total of Month.	Per cent. of Possible Duration	Temp. of Air in Sun's Rays. Highest	Date.	Mean.	Direction: Relative Proportion of at 9 a.m. N	NE	E	SE.	S.	SW.	W	NW
	hr min	On	hr. min.		Deg.	On	Deg	No	No	No	No	No	No	No	No
January	3 30	28th	15 15	6	77 0	30th	63·8	8	2	3	3	1	3	8	3
February	7 0	10th	59 40	22	92 5	19th	71·9	4	5	1	0	1	4	2	11
March	7 25	26th	66 55	18	94 8	30th	77·7	5	5	2	2	2	4	7	4
April	8 45	19th	60 5	14	99·0	19th	84·3	8	6	2	1	3	3	5	2
May	8 45	22nd	93 25	19	108 8	23rd	97 9	3	6	4	5	8	1	2	2
June	10 35	6th	183 [illegible]5	36	115 [illegible]	23rd	1[illegible]2 3	6	9	2	0	3	3	0	7
July	12 15	8th	131 10	26	111·0	14th	101·1	2	7	1	2	1	5	7	6
August	9 10	18th	90 0	[illegible]0	105 0	4th	98·2	1	1	2	1	2	6	14	4
September	8 40	29th	76 15	20	103 0	30th	88 2	6	5	1	4	3	4	3	4
October	4 40	9th	21 5	6	97 0	1st	74 1	9	8	2	0	3	4	2	3
November	4 20	3rd	27 5	11	86 8	11th	68 7	3	0	2	3	5	3	6	8
December	1 30	12th	3 15	1	63 0	17th	66 3	1	2	0	3	3	7	7	8
Means, or totals	7 13		[illegible]27 45	18	96 1		82 0	56	56	22	24	35	47	63	62

Wind: Velocity and Pressure.

Months	Velocity. At 9 a.m. Mean	Highest.	Date.	During 24 hours. Mean.	Highest	Date	Total Registered in Month	Pressure. Mean of all Daily Highest	Mean of all Daily Highest of 6 Years	Highest	Direction.	Date	Mean of Highest of Month of 6 Years
	Miles p'r hr	Miles p'r hr.	On	Miles per d	Miles per d	On	Miles.	lb. per sq. ft	lb. per sq. ft	lb. per sq. ft		On	lb. per sq. ft.
January	6·5	16 6	29th	136	261	19th	4217	1·84	3·06	10·00	W S W	26th	12·54
February	7 9	23·7	8th	189	362	9th	5280	3 60	3 00	12 00	W	9th	10 46
March	5 6	15 0	26th	134	211	21st	4140	1 79	2 19	6 25	W	26th	10·17
April	7·7	1[illegible]·0	23rd	169	292	21st	5074	1·57	2·43	4 00	W	2nd	8 21
May	5 5	12 0	31st	125	240	31st	3878	0 75	2 34	2 50	E	8th	8 54
June	6·0	11·9	1st	117	203	11th	3498	0·54	1·56	2·00	S	1st	7 04
July	6 7	13 2	11th	125	225	7th	3877	0·90	1·62	2·50	W	26th	5·67
August	6 4	14 8	28th	138	245	17th	4270	0 97	1 58	3 00	W	21st	6 38
September	5 6	14 0	3[illegible]th	108	254	27th	3245	0·98	1·91	4·00	S W	28th	6·54
October	6 9	24 9	7th	160	384	8th	4953	1·13	2 33	4 50	S	7th	6 88
November	4·7	15 8	1st	111	206	1st	3326	1 08	2 43	3 50	S W	3rd	0 83
December	4·6	25·8	18th	110	300	10th	3408	0 86	2 77	3 50	S	18th	11 00
Means, or totals	6 0	17 1		135	268		49166	1·33	2 27	4 81			8 77

Cloud. — Rain.

Months	Mean Amount of Cloud	Number of Days it fell	Rain. Amount Collected.	Greatest Daily Fall.	Date.	Mean of 20 Years	Mean of Seven Years ending with 1882, 65½ft. above surface of ground.	Mean of 7 Yrs. ending with 1882 at Town Hall and Mid. Station on surface of ground	Greater fall on surface at Town Hall & Mid. Stn. than at 65½ft. above surface at Exch. Depth in Inches	Percentage of fall at Exch'ge
	0 10	No	Ins.	Ins.	On	Ins.	Ins.	Ins.	Ins.	Per cent
January	9 1	11	0·79	0 20	30th	2 59	2 209	2 474	0 265	11 2
February	7·6	16	1·47	0·27	14th	1·88	2 609	2·972	0·363	11·4
March	7 6	14	1 86	0 59	9th	2 22	2 776	3 260	0 484	11 7
April	8 0	22	2·96	0 47	7th	2·14	2 516	2 835	0 319	11 2
May	7 3	16	2·77	0 58	25th	1·79	2·103	2 277	0 174	10 8
June	4 7	3	0 14	0 12	1st	2 28	2 837	3 011	0 174	10 6
July	6·3	16	1·78	0·44	21st	2 97	3·401	3 641	0 240	10·7
August	7·3	22	3 [illegible]5	0 47	20th	2 [illegible]4	3 654	3 892	0 238	10 7
September	7 9	14	0·92	0 [illegible]6	24th	2·71	2 894	3·229	0 335	11 2
October	7 9	20	3 83	0 56	8th	3 53	3 640	4 012	0 372	11 0
November	7 5	10	0 87	0 20	15th	2 89	3 421	3 828	0 407	11·2
December	7 4	11	1 40	0 42	21st	2 64	3·681	4 170	0 489	11 3
Means, or totals	7 4	175	22·14	0 39		30·18	35·741	39 601	3 860	11 08

S0424

OCT 11 1945
LIBRARY

METEOROLOGY OF BRADFORD FOR 1889.

Yearly Maximum and Minimum Atmospheric Pressure, Temperature, Humidity, Bright Sunshine, Wind Pressure, and Rainfall.

Year.	Pressure. Highest. Reading of Barom during Year	Date.	Pressure. Lowest. Reading of Barom during Year	Date.	Temperature. In Shade. Highest. R'ding of Maximum Thermom during Yr.	Date	Temperature. In Shade. Lowest. R'ding of Minimum Thermom during Yr.	Date
	Ins.		Ins.		Deg		Deg.	
1869	30·290	Dec. 6	28·500	Feb. 1	85·2	Aug 30	19·8	Dec 28
1870	30·284	Jan. 19	28·308	Jan. 8	85·0	July 25	16·6	Dec 23
1871	30·152	Mar. 28	28·308	Jan 16	84·0	Aug 12	6·7	Jan. 1
1872	30·156	April 6	28·070	Jan 24	86·4	July 23	24·8	Mar. 27
1873	30·338	Feb. 18	28·022	Jan. 20	88·8	July 23	19·2	Feb. 24
1874	30·476	Mar. 6	28·276	Dec. 11	80·9	July 20	15·0	Dec 31
1875	30·305	July 7	28·484	Nov. 10	80·0	Aug 17	13·0	Jan 1
1876	30·300	Jan 15	28·070	Dec 4	87·6	July 17	23·0	Jan 9
1877	30·358	Oct 6	28·300	Nov. 29	80·0	June 19	20·0	Mar. 1
1878	30·320	Mar. 16	28·630	April 1	89·6	July 19	13·9	Dec 26
1879	30·352	Dec. 13	28·500	Feb 10	74·4	July 30	13·2	Dec 7
1880	30·332	Jan. 7	28·154	Nov. 16	81·3	Sep. 5	20·8	Jan 20
1881	30·382	May 10	28·250	Oct 14	83·3	July 6	12·0	Jan. 26
1882	30·544	Jan. 18	28·452	Mar. 1	77·4	Aug 12	18·6	Dec 11
1883	30·500	April 9	28·452	Sep 2	76·2	July 3	19·8	Mar. 10
1884	30·364	Oct. 5	28·376	Jan. 27	84·4	Aug. 12	26·5	Nov. 30
1885	30·273	Mar. 14	28·400	Jan. 11	82·2	July 27	22·1	Dec. 11
1886	30·355	Nov 24	27·652	Dec. 8	79·5	July 3	17·4	Mar 7
1887	30·412	Feb. 8	28·328	Nov. 3	82·8	July 9	21·1	Jan 17
1888	30·333	Jan. 10	28·410	Mar. 28	80·4	June 27	19·2	Feb 14
1889	30·358	Dec 5	28·460	Mar. 29	77·5	Aug 1	21·3	Mar. 4
Means	30·342		28·305		82·2		18·3	

Year.	Temperature. Last and First Frost of Seasons. Date of Last Frost.	Date of First Frost.	Temperature. In Sun's Rays. Highest. Reading of Solar Thermom. during Yr.	Date.	Humidity (Complete Saturation = 100.) Highest. Degree of Humidity during Yr.	Date	Humidity. Lowest. Degree of Humidity during Yr.	Date
			Deg		0 100		0 100	
1869	Mar. 27	Oct 20	127·7	Aug 30	99	Feb 8	42	Sep 24
1870	Mar 30	Nov 9	127·5	July 25	98	Jan 29	40	July 14
1871	April 11	Nov 13	128·7	July 17	98	July 7	43	Nov 2
1872	Mar. 27	Nov 19	124·8	Aug 19	100	Mar 22	45	Sep 23
1873	Mar. 14	Nov 5	124·5	July 23	100	Dec 11	41	Mar 26
1874	Mar. 12	Nov 11	125·8	July 20	100	Feb 6	42	May 18
1875	Mar 22	Nov 26	122·0	July 5	100	Jan. 23	43	July 6
1876	April 15	Nov. 9	125·6	July 16	99	Oct 4	46	May 5
1877	May 4	Oct 18	116·4	June 19	100	Oct. 29	35	May 23
1878	April 6	Nov 9	118·2	July 22	99	Jan. 13	53	Aug 9
1879	May 10	Nov 14	101·2	Aug. 13	100	Oct 7	51	Dec. 12
1880	Feb. 23	Oct. 20	112·0	Aug. 13	99	Dec 15	50	May 30
1881	April 21	Oct 17	116·5	June 1	98	Oct 14	38	May 31
1882	April 16	Nov 12	108·0	Aug. 9	99	Nov 5	36	May 18
1883	Mar. 29	Nov. 12	107·6	May 17	99	Dec 26	30	April 9
1884	April 24	Nov 24	107·8	Aug. 9	98	Jan. 23	30	May 22
1885	April 5	Nov. 16	113·6	July 27	100	Jan. 23	32	June 4
1886	April 30	Dec 2	108·8	July 5	99	Jan 12	32	May 4
1887	April 17	Oct 12	107·6	July 9	100	April 21	35	July 9
1888	April 8	Oct 2	110·0	Sep 15	99	Mar 15	39	June 11
1889	Mar 22	Nov 27	115·2	June 23	99	April 2[illegible]	39	June 26
Means			116·6		99		40	

Year.	Bright Sunshine. Greatest Daily Duration	Date	Total of Year.	Per cent of Possible Duration	Wind Pressure. Highest.	Date	Rain. Total for Year	Mean Y'ly Rainfall at Town Hall and Mid Rly Stn on surface of g'nd	Gr'tr fall on surface at Tn H'll & Mid Stn than at 65 ft ab've surf at Ex: Depth in Inches	Percentage of fall at Exch'ge	Greatest Daily Fall during Yr	Date	Snow. Last and First Snow of Seasons. Date of Last Snow	Date of First Snow
	hr min		hr min		lb per sq ft		Ins	Ins.	Ins	Per cent	Ins			
1869												....	April 3	Oct 19
1870							24·120				0·620	June 18	Mar 24	Nov 15
1871							21·640				0·985	June 16	Mar 15	Nov. 16
1872							42·060				2·490	June 19	May 11	Nov 13
1873							21·440				1·200	Aug 4	April 25	Jan. 3, '74
1874							23·560				0·740	Dec 7	May 9	Nov 26
1875							30·280				1·700	Nov 15	Mar 12	Nov 9
1876							35·270	39·786	4·518	11·28	1·810	Oct 9	April 12	Nov 6
1877							40·650	45·499	4·849	11·19	1·420	July 16	May 19	Oct 15
1878							35·434	39·010	3·576	11·01	1·220	Aug 14	April 1	Nov 9
1879							28·017	30·298	2·281	10·82	1·020	June 8	May 7	Nov 20
1880							35·690	39·616	3·926	11·10	1·710	Oct. 27	Mar 2	Oct 27
1881							35·434	39·892	4·458	11·26	1·435	Oct 13	April 20	Oct 29
1882							39·683	43·103	3·420	10·86	1·608	Dec. 6	Mar 2[illegible]	Nov 19
1883							34·396				1·338	Sep. 26	Mar 24	Nov 10
1884					24·00	Jan 24	27·657				1·170	Jan 23	Feb 28	Nov 23
1885					15·25	Feb 4	25·699				1·208	Sep 3	May 7	Dec 9
1886	11 45	July 6	851 48	19	18·00	Dec 9	35·993				2·130	July 26	May 12	Nov. 6
1887	12 40	July 3	1120 58	25	15·00	Feb 4	18·665				0·810	Oct 9	May 21	Oct 14
1888	13 40	May 24	984 20	20	13·00	May 4	25·646				1·050	Nov 3	April 8	Oct. 1
1889	12 15	July 8	827 45	16	12·00	Feb [illegible]	22·141				0·690	Mar 9	Mar. 21	Nov 25
Means	12 35		921 15	20	16·21		30·174	39·601	3·860	11·08	1·323			

EXPLANATION.

The observations are made at nine a m , and, with the exception of maximum and minimum thermometer readings, again at three p m.

The highest and lowest barometric readings for each month, also the monthly range, are given as recorded; while the mean pressure is deduced from bi-daily observations corrected for index error, capillarity, temperature, and diurnal range. To correct for altitude or reduce to sea level (the air temperature being 48 degrees and barometer 30 inches at sea level), add ·401 inch to the heights given.

A remarkable instance of barometric depression occurred on the 8th December, 1886, when at 8 40 p m the mercury of the Exchange barometer had fallen to 27 456 inches only the lowest reading on record here The cyclone indicated by this depression was the cause of great loss of life and property, extending over an unusually large district.

All thermometric observations and deductions are given in degrees Fahrenheit.

The adopted mean temperature of air is deduced from the dry bulb and the maximum and minimum readings; the temperature of evaporation from the dry and wet bulb and the maximum and minimum readings. The dew point, elastic force of vapour, humidity, &c., are deduced from bi-daily readings of the dry and wet bulb hygrometer, by Glaisher's Hygrometrical Tables, sixth edition.

Bright sunshine is recorded in hours and minutes by glass sphere on cards, known as Campbell's recorder, fixed on Professor Stokes' zodiacal frame

The solar thermometer has a black bulb enclosed in a vacuum.

The direction, velocity, and pressure of wind are recorded as indicated by anemometers fixed 10½ feet above the ridge of roof of Exchange The velocity per hour at 9 a m is determined from anemometer readings made one minute and a half before and a like period after that hour, by multiplying the difference thereof by 20 The pressure is given in pounds avoirdupois per square foot

The amount of cloud is estimated by a scale ranging from 0 to 10.

The rain gauge is fixed upon the top of central roof of the Exchange, at an elevation of 65½ feet above the surface of the ground and 395 feet above mean sea level. As rain gauges on the summit of buildings are generally found to collect less rain than when placed upon the surface of open ground adjacent thereto, steps were taken in 1875 to determine to what extent this was the case with the Exchange rain gauge, when two additional gauges were provided and fixed upon the surface of adjacent open spaces, one near to the Town Hall, the other near to the Midland Railway Station, between which the Exchange gauge is situate about midway, and the surface of ground about the same height. At both of these gauges, as well as at the Exchange gauge, daily observations were made from the commencement of 1876 to the end of 1882, a period of seven years, when the surface gauges were removed in consequence of the ground they occupied being no longer available for the purpose. The particulars of these gaugings are set forth in tables. The results show that the mean yearly rainfall on the surface of ground for the seven years ending with 1882 is 3 86 inches, or 11 08 per cent, greater than at the summit of the Exchange. The mean yearly rainfall recorded at the Exchange for the twenty years ending with 1889 is 30·174 inches. By adding 11·08 per cent. thereto the mean normal rainfall of central Bradford for such period is found to be 33 517 inches per annum. There are good grounds for concluding that the smaller amount of rainfall collected on the Exchange—and on buildings generally—than on the surface of ground is due to the varying direction and force of wind there producing different currents and eddies, which prevent due precipitation on the top or ridge of roof where the gauge is fixed. The rainfall of 1869 was collected by a gauge placed on the ridge of outer roof of Exchange, near to the north-west corner thereof. This position not being deemed quite satisfactory, the gauge was removed at the end of that year to the ridge of central roof—the place it has since occupied. To avoid risk of inaccurate results, the rainfall of 1869 is omitted from these returns.

The instruments with which the observations are made have been verified by comparison with the standards at Kew Observatory.

SC 472A
OCT 11 19[illegible]
LIBRARY

METEOROLOGY OF BRADFORD FOR 1890.

Computed from daily observations made at the Exchange, Bradford, by John McLandsborough, M. Inst. C.E. retired, F.R.A.S., F.R.Met.Soc., F.G.S., and Alfred Eley Preston, M. Inst. C.E., F.R.Met.Soc., F.G.S.
Latitude, 53deg. 47min. 38sec. N.; longitude, 1deg. 45min. 4sec. W. Height above mean sea level, 366ft.

Pressure of Atmosphere in Month

Months	Highest Reading of Barometer	Date	Highest during 22 Years	Mean of Highest of 22 Years	Lowest Reading of Barometer	Date	Lowest during 22 Years	Mean of Lowest of 22 Years	Range	Corrected for Capillarity and Temperature: Mean	Mean of 22 Years
	Ins	On	Ins	Ins	Ins	On	Ins	Ins	Ins	Ins	Ins
January	30.538	29th	30.544	30.175	28.315	2nd	[illegible]	28.678	1.723	29.417	29.519
February	30.476	23rd	[illegible]	[illegible]	29.272	16th	28.462	28.901	1.194	29.864	29.518
March	30.203	3rd	30.446	30.140	28.843	25th	28.175	28.775	1.360	29.383	29.444
April	29.921	1st	30.501	30.07[illegible]	28.006	7th	28.332	28.837	1.013	29.436	29.470
May	30.04[illegible]	22nd	30.582	30.054	29.103	11th	28.661	29.034	0.933	29.458	29.545
June	30.200	15th	30.300	30.123	28.843	30th	28.540	29.163	1.352	29.535	29.560
July	29.976	20th	30.305	29.971	29.023	1st	28.690	29.141	0.843	29.474	29.510
August	29.947	7th	30.292	29.980	28.990	26th	28.67[illegible]	29.060	0.957	29.435	29.505
September	30.157	7th	[illegible]	[illegible]	29.276	20th	28.452	29.011	0.921	29.700	29.502
October	30.046	22nd	30.358	30.12[illegible]	29.[illegible]30	26th	28.290	28.742	1.116	29.6[illegible]5	29.4[illegible]0
November	[illegible]	20th	30.[illegible]55	30.043	28.612	7th	28.154	28.679	1.4[illegible]3	29.433	29.445
December	[illegible]	10th	30.358	30.113	28.988	19th	27.672	28.681	1.[illegible]08	29.648	29.476
Means, or totals	30.099		30.371	30.072	28.939		28.342	28.884	1.160	29.535	29.502

Temperature of Air in Shade during Month

Months	In each Month: Highest	Date	Highest during 22 Years	Mean of Highest of 22 Years	Lowest	Date	Lowest during 22 Years	Mean of Lowest of 22 Years	Range	Daily Mean in each Month: Of all Highest	Mean of 22 Years	Of all Lowest	Mean of 22 Years	Range: Mean	Mean of 22 Years	Adopted Mean Temperature: Of Dry Bulb: Mean	Mean of 22 Years	Of Air: Mean	Mean of 22 Years	Of Evaporation: Mean	Mean of 22 Years	Dew Point: Mean	Mean of 22 Years
	Deg	On	Deg	Deg	Deg	On	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg	Deg
January	54.8	7th	57.2	53.0	20.4	3rd	6.7	23.7	34.4	47.0	43.1	37.4	34.5	9.6	8.6	42.0	39.3	42.0	38.9	40.1	37.2	37.7	34.9
February	50.8	1st	57.8	53.1	29.4	18th	14.2	26.4	21.4	4[illegible].2	44.1	35.1	35.3	7.1	8.8	3[illegible].0	36.6	38.1	35.5	36.3	37.7	[illegible]	35.4
March	58.2	23rd	65.0	56.9	26.0	3rd	17.4	25.7	32.2	4[illegible].1	46.4	38.6	[illegible]	9.8	11.1	43.9	40.5	43.2	40.1	40.5	37.8	[illegible]	34.8
April	58.0	[illegible]th	71.0	63.8	22.2	1st	27.4	31.4	[illegible]	49.4	52.5	36.0	33.1	13.4	13.0	43.5	44.7	42.9	44.6	[illegible]	41.5	[illegible]	37.4
May	70.8	25th	83.9	[illegible]	[illegible]	31st	30.[illegible]	35.2	33.9	60.7	58.5	46.[illegible]	43.0	14.4	14.5	52.6	49.7	52.2	49.6	47.4	45.3	42.[illegible]	4[illegible].1
June	69.4	11th	87.8	77.0	41.6	8th	28.0	41.[illegible]	27.9	62.[illegible]	65.1	5[illegible].9	5[illegible].1	1[illegible].7	14.9	55.8	55.8	55.4	55.7	51.6	51.3	46.0	46.8
July	70.3	22nd	83.6	71.5	46.6	20th	4[illegible].0	46.4	23.7	63.4	68.1	52.[illegible]	[illegible]	10.7	14.3	58.1	[illegible]	57.2	59.6	51.8	54.2	46.9	50.0
August	75.0	6th	85.[illegible]	78.3	42.0	31st	38.6	45.[illegible]	[illegible]	64.8	67.0	52.0	53.0	11.8	14.0	56.8	58.6	56.5	58.6	[illegible]	53.9	46.4	50.1
September	76.4	1[illegible]th	[illegible]	70.7	41.0	1st	33.5	39.8	[illegible]	65.4	62.0	52.[illegible]	49.6	12.5	12.3	[illegible]	54.6	58.2	54.7	54.5	51.4	51.2	48.0
October	65.3	13th	69.[illegible]	63.2	[illegible]	28th	[illegible]	32.4	[illegible]	55.1	53.[illegible]	45.8	43.3	9.3	10.5	49.9	48.2	49.7	47.9	46.6	45.5	43.3	42.7
November	56.6	20th	[illegible]	56.4	27.0	27th	23.0	[illegible]	29.6	48.7	47.4	38.0	[illegible]	10.7	9.0	4[illegible].3	42.8	42.6	42.5	40.8	40.3	[illegible]	37.5
December	52.8	2nd	57.[illegible]	53.0	18.4	22nd	[illegible]	[illegible]	34.4	[illegible]	42.6	[illegible]	[illegible]	9.3	8.5	33.5	36.9	33.9	38.6	32.5	36.7	[illegible]	[illegible]
Means, or totals	[illegible]		[illegible]	64.6	[illegible]		[illegible]	[illegible]	30.7	53.8	54.2	43.1	[illegible]	[illegible]	11.6	47.9	47.8	47.7	47.5	44.5	44.4	41.1	41.1

Vapour

Months	Elastic Force: Mean	Mean of 22 Years	In a Cubic Foot of Air: Mean	Mean of 22 Years	Short of Saturation	Mean of 22 Years	Mean Weight of a Cubic Foot of Air	Mean of 22 Years	Degree of Humidity (Complete Saturation = 100): Highest	Date	Highest during 22 Years	Mean of Highest of 22 Years	Lowest	Date	Lowest during 22 Years	Mean of Lowest of 22 Years	Mean	Mean of 22 Years
	Ins	Ins	Grs	Grs	Grs	Grs	Grs	Grs	0–100	On	0–100	0–100	0–100	On	0–100	0–100	0–100	0–100
January	227	205	2.6	2.4	0.5	0.4	543	549	97	28th	100	97	57	3rd	34	66	86	86
February	195	206	2.3	2.4	0.5	0.4	556	548	97	24th	100	97	54	5th	42	66	85	86
March	[illegible]	203	2.6	2.4	0.6	0.6	542	547	94	23rd	99	96	53	26th	28	57	80	83
April	[illegible]	226	2.4	2.6	0.8	0.8	543	541	96	27th	100	95	43	[illegible]	[illegible]	52	75	77
May	272	259	3.1	[illegible]	1.3	1.1	[illegible]	537	99	11th	99	92	31	24th	[illegible]	44	79	73
June	[illegible]	321	3.8	3.6	1.2	1.4	530	531	91	30th	100	93	46	1st	32	48	77	72
July	321	361	3.6	4.0	[illegible]	1.7	528	526	91	17th	99	91	47	15th	35	48	68	70
August	341	363	3.8	4.1	1.3	1.5	528	527	92	11th	99	92	46	5th	41	61	74	74
September	377	337	4.2	3.8	1.2	1.0	530	531	91	17th	99	95	42	8th	38	55	78	78
October	282	276	3.2	3.2	0.3	0.7	539	538	96	22nd	99	97	49	7th	49	61	79	83
November	235	225	2.7	2.6	0.5	0.5	543	543	97	14th	[illegible]	96	65	5th	43	63	86	83
December	167	199	1.9	2.3	0.4	0.5	557	546	96	24th	100	97	46	20th	44	64	85	84
Means, or totals	205	265	3.0	3.0	0.9	0.9	539	539	95		100	95	48		37	56	[illegible]	79

Bright Sunshine; Temp. of Air in Sun's Rays; Wind Direction

Months	Bright Sunshine: Greatest Daily Duration	Date	Total of Month	Per cent of Possible Duration	Temp. of Air in Sun's Rays: Highest	Date	Mean	Direction: Relative Proportion of at 9 a.m.: N	NE	E	SE	S	SW	W	NW
	hr min	On	hr min		Deg	On	Deg	No	No	No	No	No	No	No	No
January	6 [illegible]	28th	25 25	10	75.[illegible]	2[illegible]th	61.6	5	0	0	1	2	13	5	5
February	[illegible]	3rd	19 35	7	[illegible]	3rd	51.8	11	8	2	2	0	2	1	2
March	8 20	31st	65 45	18	99.5	31st	76.1	5	1	0	2	6	7	9	1
April	7 45	22nd	73 35	13	103.[illegible]	28th	82.2	15	3	2	1	3	5	1	0
May	14 2	27th	1[illegible]2 20	27	110.2	26th	95.8	6	5	5	2	2	3	4	2
June	11 10	1st	75 [illegible]	15	111.0	16th	98.5	2	1	2	0	2	6	15	2
July	10 30	25th	103 15	[illegible]	[illegible]	31st	[illegible]	5	3	0	0	0	8	13	2
August	10 20	17th	111 [illegible]	[illegible]	107.6	17th	97.8	[illegible]	[illegible]	0	4	1	7	7	7
September	7 [illegible]	14th	110 45	29	107.8	8th	97.7	0	0	1	9	1	1	6	4
October	7 30	4th	[illegible] 40	[illegible]	102.0	13th	[illegible]	1	3	0	0	1	9	8	9
November	4 45	2nd	[illegible] 15	11	[illegible]	2nd	65.7	0	4	0	3	[illegible]	11	1	11
December	0 0		0 0	0	53.0	6th	45.7	2	15	0	10	0	2	1	1
Means, or totals	7 47		824 5	[illegible]	95.4		[illegible]	56	46	12	34	18	62	71	46

Wind: Velocity and Pressure

Months	Velocity: At 9 a.m.: Mean	Highest	Date	During 24 hours: Mean	Highest	Date	Total Registered in Month	Pressure: Mean of all Daily Highest	Mean of all Daily Highest of 7 Years	Highest	Direction	Date	Mean of Highest of Month of 7 Years
	Miles p'r h.	Miles p'r h.	On	Miles per d.	Miles per d.	On	Miles	lb per sq ft	lb per sq ft	lb per sq ft		On	lb per sq. ft.
January	8.3	28.0	9th	217	413	6th	6724	2.57	3.04	14.[illegible]0	S W	19th	12.75
February	5.9	10.3	26th	136	227	27th	3812	[illegible]	2.71	3.50	N E	27th	9.46
March	7.2	15.4	15th	[illegible]	[illegible]	11th	[illegible]	2.6[illegible]	2.25	7.05	W	8th	9.71
April	7.0	[illegible]	22nd	136	[illegible]	[illegible]	4074	1.59	2.31	7.50	S W	23rd	8.11
May	[illegible]	13.3	25th	157	246	21st	4242	1.2[illegible]	2.19	4.00	S E	21st	7.89
June	5.4	[illegible]	1st	115	[illegible]	4th	344[illegible]	1.53	1.5[illegible]	4.50	W	1[illegible]th	6.68
July	6.1	18.0	14th	[illegible]	[illegible]	14th	4077	[illegible]	1.68	7.10	W	2[illegible]	5.86
August	4.6	12.2	16th	165	[illegible]	16th	[illegible]	1.53	1.67	9.00	S W	6th	6.75
September	5.2	14.4	21st	119	233	[illegible]	3263	1.72	1.89	5.00	W	30th	6.32
October	7.3	[illegible]	5th	155	311	1st	4805	2.17	[illegible]	[illegible]	S W	[illegible]	8.68
November	6.6	[illegible]	[illegible]	[illegible]	[illegible]	23rd	4477	2.15	[illegible]	[illegible]	S W	23rd	9.46
December	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5th	[illegible]	[illegible]	[illegible]	3.00	N E	4th	9.86
Means, or totals	[illegible]	15.3		141	283		[illegible]	1.76	2.20	[illegible]			8.46

Cloud and Rain

Months	Mean Amount of Cloud	Number of Days it fell	Greatest Daily Fall	Date	Amount Collected	Mean of 21 Years	Mean of Seven Years ending with 1889, 65½ft. above surface of ground	Mean of 7 Yrs. ending with 1889 at T'n Hall and Mid. Ry. Station on surface of ground	Greater fall on surface at Town Hall & Mid. Stn. than at 65½ft. above surface at Exch.: Depth in Inches	Percentage of fall at Exch'ge
	0–10	No.	Ins	On	Ins	Ins	Ins	Ins	Ins	Per cent
January	7.6	24	1.48	22nd	4.39	2.67	2.209	2.474	0.265	11.2
February	8.3	11	0.41	16th	0.72	1.83	2.609	2.972	0.363	11.4
March	6.7	20	0.46	24th	1.8[illegible]	2.20	2.776	3.260	0.484	11.7
April	6.7	14	0.34	7th	0.87	2.08	2.516	2.835	0.319	11.2
May	5.4	12	0.72	12th	2.57	1.83	2.103	2.277	0.174	10.8
June	8.0	13	1.0[illegible]	11th	1.98	2.2[illegible]	2.837	3.011	0.174	10.6
July	6.5	1[illegible]	0.88	1st	2.45	2.94	3.401	3.641	0.240	10.7
August	6.3	[illegible]	[illegible]	11th	4.35	2.62	3.654	3.892	0.238	10.7
September	6.4	10	0.42	4th	1.30	[illegible]	2.894	3.229	0.335	11.2
October	7.0	15	[illegible]	26th	1.20	3.42	3.640	[illegible]	[illegible]	[illegible]
November	7.1	21	0.62	7th	3.17	2.91	3.421	3.828	0.407	11.2
December	9.8	15	[illegible]	24th	[illegible]	2.56	3.681	4.170	0.489	11.3
Means, or totals	7.1	194	[illegible]		[illegible]	[illegible]	35.741	39.601	[illegible]	11.08

OCT 11 194.
LIBRARY

METEOROLOGY OF BRADFORD FOR 1890.

YEARLY MAXIMUM AND MINIMUM ATMOSPHERIC PRESSURE, TEMPERATURE, HUMIDITY, BRIGHT SUNSHINE, WIND PRESSURE, AND RAINFALL.

Year	Pressure: Highest: Reading of Barom during Year (Ins.)	Date	Pressure: Lowest: Reading of Barom during Year (Ins.)	Date.	Temperature: In Shade: Highest: R'ding of Maximum Thermom during Yr (Deg.)	Date.	In Shade: Lowest: R'ding of Minimum Thermom during Yr (Deg.)	Date.	Last and First Frost of Seasons: Date of Last Frost.	Date of First Frost.	In Sun's Rays: Highest: Reading of Solar Thermom during Yr (Deg.)	Date.
1869	30 290	Dec. 6	28 500	Feb 1	85 2	Aug. 30	19 8	Dec 28	Mar. 27	Oct 20	127·7	Aug 30
1870	30 284	Jan 19	28 308	Jan 8	85 0	July 25	16·6	Dec 23	Mar 30	Nov. 9	127 5	July 25
1871	30 152	Mar 28	28 308	Jan 16	84 0	Aug 12	6 7	Jan 1	April 11	Nov. 13	128 7	July 17
1872	30 156	April 6	28 070	Jan 24	86 4	July 23	24·8	Mar. 27	Mar 27	Nov. 19	124 8	Aug 19
1873	30 358	Feb 18	28 022	Jan 20	88 8	July 23	19·2	Feb. 24	Mar. 14	Nov 5	124 6	July 23
1874	30 476	Mar 6	28 276	Dec 11	80 9	July 20	15·0	Dec. 31	Mar. 12	Nov. 11	125 8	July 20
1875	30 305	July 7	28 484	Nov 10	80 0	Aug. 17	13 0	Jan. 1	Mar 22	Nov 26	122 0	July 5
1876	30 300	Jan 15	28 070	Dec 4	87 6	July 17	23·0	Jan. 8	April 15	Nov. 9	125 6	July 16
1877	30 356	Oct 6	28 300	Nov 29	80 0	June 19	20 0	Mar. 1	May 4	Oct 18	116 4	June 19
1878	30 320	Mar 16	28 630	April 1	89 6	July 19	13 9	Dec. 26	April 6	Nov [illegible]	118 2	July 22
1879	30 352	Dec. 13	28 500	Feb 10	74 4	July 30	13·2	Dec. 7	May 1[illegible]	Nov. 14	101 2	Aug 1[illegible]
1880	30 332	Jan 7	28 154	Nov 16	81 3	Sep 5	20·8	Jan. 20	Feb. 23	Oct 20	112 0	Aug. 13
1881	30 382	May 10	28 250	Oct 14	83 3	July 6	12 0	Jan. 26	April 21	Oct 17	116 5	June 1
1882	30 544	Jan 18	28 452	Mar 1	77 4	Aug 12	18 6	Dec. 11	April 16	Nov. 12	108 0	Aug. 9
1883	30 500	April 9	28 452	Sep 2	76 2	July 3	19 8	Mar. 10	Mar. 29	Nov 12	107 6	May 17
1884	30 354	Oct 5	28 376	Jan 27	84 4	Aug. 12	26·5	Nov 30	April 24	Nov 24	117 3	Aug 9
1885	30 273	Mar 14	28 460	Jan 11	82 2	July 27	22·1	Dec. 11	April 5	Nov 16	113 6	July 27
1886	30 365	Nov 24	27 652	Dec 8	79 5	July 3	17 4	Mar. 7	April 30	Dec 2	108 6	July 5
1887	30 412	Feb 3	28 378	Nov 3	82 6	July [illegible]	21·1	Jan. 17	April 17	Oct 12	[illegible]	July [illegible]
1888	[illegible] 333	Jan 10	28 410	Mar 28	80 4	June 27	19 2	Feb. 14	April 3	Oct 2	110 0	Sep 1[illegible]
1889	30 358	Dec. 5	28·460	Mar. 2[illegible]	77 5	Aug 1	21·3	Mar. 4	Mar. 22	Nov 27	115 2	June 2[illegible]
1890	30 375	Feb. 23	28 315	Jan 23	76 4	Sept. 10	18 4	Dec. 22	Mar 10	Oct 28	11[illegible]·0	June [illegible]
Means	30 343		[illegible]8 [illegible]05		8[illegible]		1[illegible]				116 4	

Year	Humidity (Complete Saturation = 100): Highest: Degree of Humidity during Yr (0–100)	Date	Lowest: Degree of Humidity during Yr (0–100)	Date.	Bright Sunshine: Greatest Daily Duration (hr min)	Date.	Total of Year (hr min)	Per cent of Possible Duration
1869	99	Feb 8	42	Sep 24				
1870	98	Jan 29	29	Mar 1				
1871	98	July 7	43	Nov 2				
1872	100	Mar 22	45	Sep 23				
1873	100	Dec. 11	41	Mar. 26				
1874	100	Feb 6	42	May 19				
1875	100	Jan 23	43	July 6				
1876	99	Oct 4	46	May 5				
1877	100	Oct 29	35	May 23				
1878	99	Jan 13	53	Aug 9				
1879	100	Oct 7	51	Dec 12				
1880	99	Dec. 15	50	May 30				
1881	98	Oct 14	38	May 31				
1882	99	Nov. 5	36	May 18				
1883	99	Dec 26	30	April 9				
1884	98	Jan. 23	30	May 22				
1885	100	Jan 23	32	June 4				
1886	99	Jan 12	32	May 4	11 45	July [illegible]	[illegible]	19
1887	100	April 21	35	July 9	12 40	July [illegible]	[illegible]	25
1888	[illegible]	Mar 15	39	June 11	13 4[illegible]	May 24	[illegible]	20
1889	99	April 22	29	June 26	1[illegible] 15	July [illegible]	827 45	18
1890	9[illegible]	May 11	31	May 29	14 25	May [illegible]	[illegible]	[illegible]
Means	[illegible]		39		12 57		[illegible] 47	20

Year	Wind Pressure: Highest (lb. per sq ft)	Date.	Rain: Total for Year (Ins)	Mean Y'rly Rainfall at Town Hall and Mid Rly Stn on surface of ground (Ins.)	Gt'r fall on su'f at T'n H'll & M. R. Stn. than at 65½ ft. ab've surf at Exc.: Depth in Inches (Ins)	Percentage of fall at Exch'ge (Per cent.)	Greatest Daily Fall during Yr (Ins)	Date.	Snow: Last and First Days of Seasons: Date of Last Snow	Date of First Snow
1869								...	April 3	Oct. 19
1870			24 120				0 [illegible]20	June 18	Mar 24	Nov 15
1871			21 640				0 985	June 16	Mar 15	Nov 16
1872			42 06[illegible]				2 49[illegible]	June 19	Mar 11	Nov 13
1873			21 440				1 20[illegible]	Aug 4	April 25	Jan 3, '74
1874			23 5[illegible]0				0 740	Dec 7	May 9	Nov 26
1875			[illegible]				1 [illegible]0	Nov. 15	Mar 12	Nov 9
1876			35 270	[illegible]	4 518	11 28	1 810	Oct. 9	April 12	Nov 6
1877			40 650	45 499	4 849	11 19	1 420	July 18	May 19	Oct 15
1878			35 434	39 010	3 576	11 01	1 220	Aug. 14	April 1	Nov 8
1879			28 017	30 298	2 281	10 8[illegible]	1·020	June 6	May 7	Nov 20
1880			[illegible]5 6[illegible]0	39 616	3 926	11 10	1 710	Oct 27	Mar 2	Oct 27
1881			[illegible]5 434	39 892	4 458	11 26	1 435	Oct 13	April 20	Oct 23
1882			39 683	43·103	3·420	[illegible]	1 6[illegible]5	Dec 6	Mar 21	Nov 19
1883			[illegible]96				1 [illegible]	Sep 26	[illegible] 24	Nov 10
1884	24 00	Jan. 24	27 657				1 170	Jan 23	[illegible] 28	Nov 23
1885	15 25	Feb 4	25 [illegible]				1 208	Sep 3	Mar 7	Dec 9
1886	18 [illegible]	Dec 9	[illegible]5 9[illegible]				2·130	July 2[illegible]	Mar 12	Nov 6
1887	15 00	Feb 4	[illegible]				0 81[illegible]	Oct 9	Mar 21	Oct 14
1888	13 00	Mar 4	25 6[illegible]6				1 050	Nov 3	April 8	Oct 1
1889	12·00	Feb [illegible]	[illegible]				[illegible]	Mar [illegible]	[illegible]	Nov 25
1890	14 0	Jan 1[illegible]	[illegible]5 730				1 43[illegible]	Jan 2[illegible]	[illegible]	Oct 21
Means	15 8[illegible]		[illegible]9 962	[illegible]	3 860	11·08	1·330			

EXPLANATION.

The observations are made at nine a m , and, with the exception of maximum and minimum thermometer readings, again at three p m

The highest and lowest barometric readings for each month, also the monthly range, are given as recorded; while the mean pressure is deduced from bi-daily observations corrected for index error, capillarity, temperature, and diurnal range To correct for altitude or reduce to sea level the air temperature being 48 degrees and barometer 30 inches at sea level, add 401 inch to the heights given

A remarkable instance of barometric depression occurred on the 8th December, 1886, when at 6 40 p m the mercury of the Exchange barometer had fallen to 27 456 inches only the lowest reading on record here The cyclone indicated by this depression was the cause of great loss of life and property, extending over an unusually large district.

All thermometric observations and deductions are given in degrees Fahrenheit.

The adopted mean temperature of air is deduced from the dry bulb and the maximum and minimum readings; the temperature of evaporation from the dry and wet bulb and the maximum and minimum readings. The dew point, elastic force of vapour, humidity, &c., are deduced from bi-daily readings of the dry and wet bulb hygrometer, by Glaisher's Hygrometrical Tables, sixth edition

Bright sunshine is recorded in hours and minutes by glass sphere on cards, known as Campbell's recorder, fixed on Professor Stokes' zodiacal frame

The solar thermometer has a black bulb enclosed in a vacuum.

The direction, velocity, and pressure of wind are recorded as indicated by anemometers fixed 10½ feet above the ridge of roof of Exchange. The velocity per hour at 9 a m. is determined from anemometer readings made one minute and a half before and a like period after that hour, by multiplying the difference thereof by 20. The pressure is given in pounds avoirdupois per square foot.

The amount of cloud is estimated by a scale ranging from 0 to 10.

The rain gauge is fixed upon the top of central roof of the Exchange, at an elevation of 65½ feet above the surface of the ground and 395 feet above mean sea level. As rain gauges on the summit of buildings are generally found to collect less rain than when placed upon the surface of open ground adjacent thereto, steps were taken in 1875 to determine to what extent this was the case with the Exchange rain gauge, when two additional gauges were provided and fixed upon the surface of adjacent open spaces, one near to the Town Hall, the other near to the Midland Railway Station, between which the Exchange gauge is situate about midway, and the surface of ground about the same height. At both of these gauges, as well as at the Exchange gauge, daily observations were made from the commencement of 1876 to the end of 1882, a period of seven years, when the surface gauges were removed in consequence of the ground they occupied being no longer available for the purpose. The particulars of these gaugings are set forth in tables. The results show that the mean yearly rainfall on the surface of ground for the seven years ending with 1882 is 3 [illegible] inches, or 11 08 per cent greater than at the summit of the Exchange. The mean yearly rainfall recorded at the Exchange for the twenty-one years ending with 1890 is 29 962 inches. By adding 11 [illegible] per cent thereto the mean normal rainfall of central Bradford for such period is found to be 33 [illegible] inches per annum. There are good grounds for concluding that the smaller amount of rainfall collected on the Exchange—and on buildings generally—than on the surface of ground is due to the varying direction and force of wind there producing different currents and eddies, which prevent due precipitation on the top or ridge of roof where the gauge is fixed. The rainfall of 1869 was collected by a gauge placed on the ridge of outer roof of Exchange, near to the north-west corner thereof. This position not being deemed quite satisfactory, the gauge was removed at the end of that year to the ridge of central roof—the place it has since occupied. To avoid risk of inaccurate results, the rainfall of 1869 is omitted from these returns.

The instruments with which the observations are made have been verified by comparison with the standards at Kew Observatory

Yorkshire Naturalists' Union.

President:

WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S., Oatlands Park, Weybridge, Surrey.

Ex-Presidents:

Rev. Wm. Fowler, M.A., Liversedge.
H. Clifton Sorby, LL.D, F.R.S., etc., Sheffield.
Prof. W. C. Williamson, LL.D., F.R.S., Manchester.
John Gilbert Baker, F.R.S., F.L.S., Kew.
Rt. Hon. Lord Walsingham, M.A., F.R.S., Thetford, Norfolk.
Rev. W. H. Dallinger, LL.D., F.R.S., Pres.R.M.S., Sheffield.
Sir Ralph Payne-Gallwey, Bart., M.B.O.U., Thirkleby Park.

Secretaries:

Wm. Denison Roebuck, F.L.S., Sunny Bank, Leeds.
Wm. Eagle Clarke, F.L.S., Headingley, Leeds.

THE SEVENTY-SECOND MEETING

WILL BE HELD AT

LEYBURN,

FOR THE INVESTIGATION OF

Leyburn Shawl, Bolton Castle, Scarth Nick, Keldhead Mines, and in general that portion of the Northern Escarpments of Wensleydale between Redmire and Leyburn,

On WHIT-MONDAY, MAY 21st, 1888.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Redmire, to Members and Associates of the Y.N.U. producing their signed card of Membership.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

Members will leave Redmire Station after the arrival of the 11-50 train from Northallerton, and will walk to Leyburn by way of Bolton Castle, Bolton Gill, along Redmire Scar to Scarth Nick, via Preston-under-Scar to Keldheads Lead Mines, and along Leyburn Shawl to

Leyburn—distance about five miles. The party will be accompanied by Messrs. Arthure (President of the Leyburn Society), Wm. Horne, F.G.S., J. A. Rodwell, and other members of the local society.

Permission is granted by Lord Bolton for members to visit his estates, and by the Hon. W. T. Orde-Powlett for them to inspect his Ethnological and Archæological Museum he has formed at Bolton Castle.

Books and Maps.

The whole district is comprised in Sheet 97 N.E. of the One-inch and Sheets 67 and 68 of the Six-inch Ordnance Maps. The Geological Maps are not yet published. For further information see Phillips' Works—and Papers published in 'The Naturalist' on the Birds (by E. Chapman, Nat., June, 1886, p. 183), the Mollusca (by W. Denison Roebuck, Nat., Jan., 1883, p. 81), and the Flowering Plants (Jno. Percival, Nat., May, 1888, p. 125). References to the Fauna and Flora are also given in Whitaker's 'Richmondshire,' Barker's 'Three Days of Wensleydale,' and other topographical works.

Physical Geography and Geology.

Mr. J. W. Davis, F.G.S., F.L.S., &c., furnishes the following:—

The strata in the neighbourhood of Leyburn, in Wensleydale, form the typical series to which the late Prof. Phillips gave the name of the 'Yoredales.' The thick-bedded massive Limestone, which in the northern parts of Craven attains a thickness of 600 to 1000 feet, becomes further north divided by intercalations of beds of Shale and Sandstone, which constantly increase in thickness and importance in their progress towards Leyburn; the Limestone, on the other hand, thus divided, gradually decreases in thickness. In Wensleydale the variety of alternations reaches its maximum, and in the Upper Beds there are one or two thin seams of coal. The Main Limestone, or 'Red Beds,' forms the escarpment denominated the 'Leyburn Shawl'; it is 60 or 70 feet beneath the base of the Millstone Grits. In this Limestone Mr. William Horne has discovered a small cave from which bones of man and other evidences of his occupation have been obtained; beneath the shelter of the escarpment nearer Leyburn are the remains of an ancient burial ground, and a remarkable tumulus, composed of masses of Limestone. The objects found in the investigation of these remains have been deposited, with the kind permission of Lord Bolton, in a room at Bolton Castle.

About half-a-mile east of Leyburn station the Red Limestone descends to a level with the railway lines and has been quarried at Harmby. It is from this quarry that Mr. Horne has obtained a large number of fish-remains; they principally occur on an horizon about thirty feet below the surface; they consist mostly of fossil teeth with occasional spines, and are scattered over the surface, when newly exposed, in large numbers; they are, however, very difficult to detach and fracture with the Limestone, so that comparatively few good specimens can be obtained.

At Keld-head, near the Redmire station, Lead is mined, and the Keld-head Limestone contains very fine and large specimens of Productus and other fossils. Between this Limestone and the Main Limestone of the Shawl there are three beds with intermediate Shales and Grits, together with six inches of Coal, the whole occupying about 480 feet in thickness, whilst beneath there is a similar series of 430 feet; the lowest Limestone occupying the bottom of the valley is of unknown thickness. The total thickness of the series, including the strata above the Main Limestone, is nearly 1000 feet.

Botany.

Mr. John Percival, B.A., communicates the following :—

Perhaps the best course to adopt in the investigation of the flora of this district will be for one contingent to take the lower part of the valley and another the higher part along the Scars. The former route, though less interesting from a picturesque point of view, will well repay a visit, especially the woods near the river below Redmire and about Bolton Hall. Both sections could then join each other on the hill above Wensley station, for combined work on the Shawl and woods here.

On the castle at Bolton may be observed *Parietaria diffusa*, and in the fields near the church *Berberis vulgaris* occurs. After leaving the village, Bolton Gill, which extends for about a mile up the hill, is soon reached and yields many interesting species. On nearly all the Scars all along the route may be obtained *Hutchinsia petræa*, *Asplenium trichomanes*, *A. ruta-muraria*, *A. viride* (sparingly) with *Viola lutea* on the moorland above. *Saxifraga granulata* and *Hippocrepis comosa* grow about Scarth Nick and Preston ; below the latter place *Asplenium adiantum-nigrum* may be found among grit tumble.

In the Shawl woods will be collected—*Euonymus europæus*, *Geum intermedium*, *Myosotis sylvatica*, *M. collina*, *Melampyrum pratense* var. *montanum*, *Lathræa squamaria* (on the Ash), *Gagea lutea*, &c. It will be rather early for *Orobanche rubra*, and it is now fast disappearing altogether. *Helleborus viridis* may be seen in its later stages in the woods near Leyburn. The ground about the Flag Quarries just above the Shawl is interesting and yields *Teesdalia nudicaulis*, *Arenaria verna* and *Sagina ciliata*. Several Aliens occur in the planted wood near here. The whole district is fairly rich in cryptogamic forms.

Entomology.

Very scant attention appears to have been paid to the Entomological Fauna of this district, and Porritt's 'List of Yorkshire Lepidoptera' has its references from this district few and very far between.

Conchology.

Mr. W. Denison Roebuck, F.L.S., furnishes the following notes:—

The district to be traversed on this occasion is one of conchological interest, and the prevalence of limestone in its soil is evidenced by the presence of several usually uncommon species. A piece of waste land situate at the point where the railway crosses the Apedale Beck

about a hundred yards from Redmire station, may be searched with advantage for *Bulimus obscurus*, *Helix rufescens*, *Clausilia rugosa*, *Zua lubrica*, etc. At Bolton Castle have been taken *Limax arborum*, *Zonites cellarius*, *Z. glaber*, *Helix arbustorum*, etc. On walls about Castle Banks and by roadsides leading up to Scarth Nick *H. lapicida* is abundant, while *Balea perversa* and *Helix rupestris* are by no means uncommon along the whole escarpment from Scarth Nick to Leyburn Shawl. Conchological visits to this part of Wensleydale having only been flying ones, there are numerous other species which may be looked for with full expectation of success. The list for all Wensleydale, published in 1882, included 52 species and varieties, of which 10 only were aquatic forms.

Vertebrate Zoology.

Mr. James Carter, of Burton House, Masham, furnishes the following notes :—

The varied and extensive character of the district of Wensleydale to be visited offers a rare opportunity for observation to all who are interested in its vertebrate fauna. The Mammalia and Fishes are well represented, and the Avifauna is of such a comprehensive character (both numerically and in rarity) that it is a somewhat difficult task to particularize. The river Yore is the resort of the Kingfisher, Dipper, Sandpiper, Heron, etc. The beautiful woods and grounds of Bolton Hall, also the hanging woods and coppices of Leyburn Shawl and Scarth Nick are frequented by most of our warblers and spring migrants, besides many residents, whilst on the adjacent moorlands may be seen the Merlin, Curlew, Golden Plover, Grouse, Snipe, Kestrel, Sparrowhawk, Ring Ouzel, etc. The rarer visitors to the district include the Rough-legged Buzzard, Peregrine Falcon, Hen Harrier, Pied Flycatcher, Waxwing, Stonechat, Blackcock, Green Sandpiper, and other rare species, including the Sclavonian Grebe, of which specimens obtained a few months ago on the river Yore may now be seen at Mr. Chapman's, at Carperby, where they were sent for preservation.

Programme of Meetings.

5- 0 p.m.—Meat Tea, 2/- each, at the Golden Lion Hotel, Leyburn

6- 0 p.m.—Sectional Meetings } In the Public Hall.
6-30 p.m.—General Meetings }

7-35 p.m.—Departure of Train.

Yorkshire Naturalists' Union.

President:

WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S., Oatlands Park, Weybridge, Surrey.

Ex-Presidents:

Rev. Wm. Fowler, M.A., Liversedge.
H. Clifton Sorby, LL.D, F.R.S., etc., Sheffield.
Prof. W. C. Williamson, LL.D., F.R.S., Manchester.
John Gilbert Baker, F.R.S., F.L.S., Kew.
Rt. Hon. Lord Walsingham, M.A., F.R.S., Thetford, Norfolk.
Rev. W. H. Dallinger, LL.D., F.R.S., Pres.R.M.S., Sheffield.
Sir Ralph Payne-Gallwey, Bart., M.B.O.U., Thirkleby Park.

Secretaries:

Wm. Denison Roebuck, F.L.S., Sunny Bank, Leeds.
Wm. Eagle Clarke, F.L.S., Museum, Edinburgh.

THE SEVENTY-THIRD MEETING

WILL BE HELD AT

UPPERMILL,

FOR THE INVESTIGATION OF THE

SADDLEWORTH

District, including

the Greenfield and Chew Valleys, Bill's-o'-Jack's, the Oldham Waterworks at Denshaw, etc.,

On SATURDAY, JUNE 16th, 1888.

The chair at the General Meeting will be taken by Prof. W. C. Williamson, LL.D., F.R.S., and it is expected that a number of leading Lancashire naturalists and local residents will join in the excursion.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Greenfield or Diggle to Members and Associates of the Y.N.U. producing their signed card of Membership.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

Route I.—Geological.—To start at 10-1 a.m. from Diggle station over Harrop Edge to Castleshaw (Roman Station) and the Oldham Corporation waterworks now in course of construction there, the 'puddle gutters' not being quite filled, and thence to the top of Noddle (marked on Five-inch Ordnance Map), and back to Delph and Uppermill. Leaders, Messrs. Wm. Watts, F.G.S. (Engineer to the Oldham Waterworks), and Morgan Brierley (the historian of Saddleworth).

Route II.—10-10 a.m., Members will leave Greenfield Station and work up the Greenfield Valley to Seal Bark and Bill's-o'-Jack's, and across Church Moors to Uppermill.

The Chew Valley may also be worked from Greenfield Station.

Permission is granted by the Vicar of Uppermill for the use of the Lee Street School-room for the meetings.

Books and Maps.

The whole district is comprised in Sheet 88 S.W. of the One-inch Ordnance Map. which may also be had geologically coloured. Mr. Morgan Brierley's History of Saddleworth contains a geological chapter by Mr. James Nield. See also Davis and Lees' 'West Yorkshire.'

Physical Geography and Geology.

Mr. Percy F. Kendall (Owens College) writes the following :—

The Saddleworth district affords an excellent illustration of a geological inlier. The Yoredale rocks and the overlying Millstone Grit have been thrown into an anticlinal fold running in a general North and South direction, but complicated by minor undulations at right angles. From the summit of the ridge the Millstone Grit has been removed, exposing the Yoredales. The Yoredale series consists of Shales and Grits, the former containing intercalated bands of black Limestone which are often crowded with Goniatites, Orthoceras, and other fossils. The anticlinal axis coincides roughly in position with a fault of small throw but extending to a distance of about twelve miles, and many smaller, sub-parallel faults traverse the adjacent country, one of them crossing the village of Saddleworth. The Millstone Grit completely encircles the Yoredales and rises on the North and East into a series of flat-topped hills presenting the features of moorland scenery so characteristic of the formation. About two miles North of Saddleworth is an outcrop of coal occurring as a lenticular seam in the Millstone Grit.

Botany.

Messrs. John Whitehead (Oldham) and J. R. Byrom (Manchester) furnish the following notes :—

In the Greenfield valley the following plants occur—but it will be too early in the season for most of the phanerogams—viz. :—*Drosera rotundifolia*, *Hypericum elodes*, *H. dubium*, *Rubus chamæmorus*, *Carlina*

vulgaris, *Arctostaphylos uva-ursi*, *Pinguicula vulgaris*, *Scutellaria minor*, *Listera cordata*, and *Malaxis paludosa*. For the latter this is the only habitat in West Yorkshire. Amongst ferns and their allies, may be mentioned—*Hymenophyllum tunbridgense*, *H. unilaterale*, *Cystopteris fragilis* var. *dentata*, and *Lycopodium selago*. The most important mosses are *Sphagnum subsecundum*, *Andrææa petrophylla*, *Seligeria recurvata*, *Brachiodus trichodes*, *Splachnum sphæricum*, *S. ampullaceum*, *Discelium nudum*, *Entosthodon ericetorum*, *Philonotis calcarea*, *Mnium undulatum* (in fruit), *Tetrodontium brownianum*, *Atrichum crispum*, *Diphyscium foliosum*, *Buxbaumia aphylla* (Ogden Clough), *Fissidens fontanus*, *Pterygophyllum lucens*, *Hyocomium flagellare*, *Hypnum falcatum*, and *H. stramineum* (in fruit).

Entomology.

Mr. Geo. T. Porritt, F.L.S., F.E.S., communicates the following:—

The Saddleworth district is a good one entomologically, but the date of the excursion is unfortunate. The northern and local *Gelechia politella* occurs in profusion in the wood and on the grassy slope of the adjoining moorland overhanging Greenfield railway station, at the end of June and first fortnight in July, and may possibly be just getting out at the date of the meeting. *Phoxopteryx myrtillana* should be plentiful among Bilberry; larvæ of *Larentia didymata* and *Hypsipetes elutata* are well worth collecting in large numbers for breeding the fine dark moorland forms of these species which occur there; and if not too late this backward season plenty of those of *Cidaria populata* may be secured, with perhaps those of *Oporabia filigrammaria* and *Larentia cæsiata*. Imagines of *Bombyx quercus*, *Acidalia fumata*, *Melanippe galiata*, *Acronycta menyanthidis*, *Hadena adusta*, *H. glauca*, *Anarta myrtilli*, *Clepsis rusticana*, *Coleophora vitisella*, and many others ought to be taken. *Celæna haworthii* abounds in August and September all over the moors, but is not so easily found in its earlier stages in the roots of cotton-grass; *Penthina sauciana* is almost equally plentiful among bilberry in July, and its larvæ may yet probably be collected, along with those of *Grapholita geminana*, *Peronea caledoniana*, and *Exapate gelatella*, which are all very common. Among Trichoptera the northern *Asynarchus cœnosa* is abundant at the beginning of September, and its larval cases ought now to be readily found in the shallow pools on the moors.

Conchology.

Mr. Thomas Rogers (Manchester) fears that the district is very poor from a conchological point of view. He has never searched the district for shells, but during his little excursions in that neighbourhood he does not remember seeing anything worth recording amongst land shells. There is a canal which probably might yield some fresh-water shells; he has, however, never tried it himself.

In the canal at Mossley, Mr. Edward Collier has found *Limnæa peregra*, *L. auricularia*, *Sphærium corneum*, and *S. ovale*.

Vertebrate Zoology.

Mr. William Beaumont (Ashton-under-Lyne) writes as follows :—

The district is rather favourable for birds, as they have not been disturbed by much building or very extensive improvements in farming, and the protection given to game on the moorlands is also a protection to the small birds. I have been very much surprised in my rambles to find birds so numerous. The Sparrowhawk, Kestrel, and Merlin occur, while the Barn and Tawny Owls and Goatsucker are found in the quieter parts of the district. The Missel Thrush, Song Thrush, Blackbird, Fieldfare, Redwing, Ring Ouzel, and Dipper are found about the hills, and we have the Wagtails (Yellow and Pied), Stonechat, Whinchat, and Wheatear, all the common warblers, including the Sedge Warbler, Whitethroat, and Willow Wren. Robins, Wrens, and Hedge Sparrows are very common, and the Gold-crest occurs. The Great Tit, Blue Tit, Skylark, Meadow Pipit, Tree Pipit, Yellow Hammer, Black-headed Bunting, and most of the Finches are with us. The Kingfisher, all the Swallows, Starling, Crows, Grouse, Partridge, Moorhen, Coot, Dabchick, Snipe, Jack Snipe, Sandpiper, Land Rail, Water Rail, Golden Plover, Lapwing, Mallard, Teal, and Wigeon have been seen in the neighbourhood, and several casual visitors have been met with. The Red-crested Grebe and Storm Petrel in the possession of the Mossley Naturalists' Society were both caught in the neighbourhood of Wharmston. The Ring Ouzel and Wheatear breed freely about the moors ; the nest of the former Mr. G. T. Porritt has found more than once at very short distances from the high road near Diggle.

Of Mammals, the Long-eared and Common Bats, the Fox, Hedgehog, Polecat, Stoat, Weasel, Mole, Rat, Water and Field Voles, Water and Common Shrews, Hare, and Rabbit inhabit the district ; and of Reptiles the Common Lizard, Blind Worm (rare), Frog, Toad, and Common and Smooth Newts.

Micro-Zoology and Botany.

Mr. J. R. Robinson, F.R.M.S. (Mossley), furnishes the following :

Some six or seven years ago I, with others, hunted the district through, and the only objects found were a few *Hydra viridis* at Delph, not met with since. There was a very good microscopist in Uppermill, a Police-sergeant, who was always on the look out for objects in the ponds and ditches, but did not find anything. So far as I know Micro-Zoology and Micro-Botany seem to be a blank in Saddleworth.

Programme of Meetings.

4-30 p.m.—Meat Tea, 2/- each, Hare and Hounds Inn, Uppermill.

5-30 p.m.—Sectional Meetings } In the Lee Street School-room,
6- 0 p.m.—General Meetings } Uppermill.

7-7 p.m., 8-48 p.m.—Departure of Trains from Saddleworth Station.

Yorkshire Naturalists' Union.

President:
WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S., Oatlands Park, Weybridge, Surrey.

Secretaries:
Wm. Denison Roebuck, F.L.S., Sunny Bank, Leeds.
Wm. Eagle Clarke, F.L.S., Museum, Edinburgh.

The SEVENTY-FOURTH MEETING

WILL BE HELD AT

SCARBOROUGH,

FOR THE INVESTIGATION OF

THE PEAK AND THE SOUTHERN PORTION OF

ROBIN HOOD'S BAY,

On MONDAY, JULY 16th, 1888.

The chair at the General Meeting will be taken by the President.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Robin Hood's Bay, Fyling Hall, or Peak Stations to Members and Associates of the Y.N.U. producing their signed card of Membership. Members travelling viâ Whitby may book to Scarborough, with liberty to break journey at Robin Hood's Bay, Fyling Hall, or Peak Stations.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

Route I.—Geological.—To be led by the President of the Union (Mr. W. H. Hudleston, M.A., F.R.S.). To start from Peak station, on the arrival of the 11-10 a.m. train, proceed in the direction of Crag Hall Quarry, and thence return by the same route for a short distance, proceed to where the Peak fault is seen in the cliff, descend to the shore, pass over Blue Wyke Point, and re-ascend the cliffs by the path underneath the station.

Route II.—Zoologists and Botanists would do well to work Ramsdale Woods and the Mill Beck Valley (from Fyling Hall Station).

Route III.—Marine Zoologists and Botanists will find the tide suitable. The tide will be low during the Excursion, high-water being at 9 p.m.

Books and Maps.

The whole district is comprised in Sheet 95 N.W. of the One-inch (and Sheet 47 of the Six-inch) Ordnance Map, which may also be had geologically coloured. Tate & Blake's 'Yorkshire Lias'—which gives

sections of Robin Hood's Bay—is the chief authority ; see also the Geological Survey Memoirs, Baker's 'North Yorkshire,' Phillips' 'Geology of the Yorkshire Coast,' and 'The Yorkshire Oolites' (Proc. Geol. Assoc., Vol. iii, No. 7).

Physical Geography and Geology.

Mr. Hudleston writes the following :—

This district affords a favourable opportunity for the study of portions of the Lias and Inferior Oolite. Many of the zones of the Lower Lias are well displayed in the scars which are uncovered at low water, and which are more or less conformable to the general curve of the Bay. The Peak forms the South 'Cheek' of the Bay. According to the mapping of the Geological Survey the effect of the Peak fault on these scars is to throw the beds of the zones of *Am. armatus* and *Am. oxynotus* against the *margaritatus*-beds of the Middle Lias, which latter constitute a projecting tongue of rock enclosed within a fork of the fault. The frontispiece to Young and Bird's 'Geological Survey of the Yorkshire Coast' represents 'a view of the remarkable break in the strata at Peak' as seen from this projecting tongue of rock, which may be said to separate Robin Hood's Bay from Blue Wyke Bay.

In the cliff itself the effect of this great fault is to bring the Middle Lias into juxtaposition with the Lower Estuarine Series of the Inferior Oolite, the beds on the downthrow side curving towards it, but ultimately assuming a strong dip in the opposite direction, i.e., S.E. Peak Hill, which has an elevation of about 600 feet, is in a great measure the result of this fine stratigraphical feature. It thus possesses a certain resemblance to Scarborough Castle Hill, whose northern precipice is due to a fault having a similar direction. But in the case of the Castle Hill a cross fault has helped to wedge out the entire mass from the adjacent country, which is not so at the Peak. In each case the hill is on the downthrow side, but the removal of the upthrow side at the Peak has been less complete than at Scarborough. The throw of the Peak fault is about 400 feet.

The summit cutting of the railway does not show a section of the fault, but its effects are seen on the downthrow side by the strong curve in the beds of the Middle Estuarine, whilst a short distance towards the north, the 'alum shale,' or *communis*-beds are observed in the next cutting. An interesting section in the old alum quarry close by (Crag Hall) displays the 'alum shale,' surmounted by the Dogger, *here only four feet thick*, which is succeeded by the Lower Shale and Sandstone (Lower Estuarine). A peculiar feature in connection with the development of the Jurassic rocks of this district is the attenuation of the Dogger and carrying Sandrock, the total absence of the *striatalus*- or *jurensis*-beds, and a probable loss of a portion of the *communis*-beds, all of which are seen to be largely developed on the downthrow side of the fault in the Peak, not quite half-a-mile distant.

From the Peak to Blue Wyke Point that portion of the cliffs which faces the sea presents a noble series of precipices, of which the 'alum shale' at first constitutes the base, succeeded by the *jurensis*-beds,

not developed elsewhere in this part of Yorkshire—then the Grey Sandrock of the Dogger (*Lingula* bed), the Yellow Sandrock, and lastly, the true Dogger. Owing to the strong S.E. dip these beds plunge one after another beneath the sea.

The Grey Sandrock of the Dogger constitutes the little platform of Blue Wyke Point, being harder than the *striatulus* beds below, out of which Blue Wyke has been excavated, and also harder than the Yellow Sandrock above, which has been eaten back to the very base of the cliff. Continuing in the direction of the dip (S.E.) the true Dogger is seen to approach the shore line, where it may be conveniently studied before plunging, in its turn, beneath the sea. The Dogger, as developed in the Peak cliffs and at Blue Wyke Point, exceeds 30 ft. in thickness. It is a chocolate-coloured Sandstone, often somewhat marly, and has a variable charge of iron, in places losing somewhat of its sandy character and becoming oolitic. The upper-beds are probably the most rich in iron, which occurs partly as carbonate. It has never been worked here. The Dogger at this place is remarkable for a number of Nodular beds, the lowest of which is often charged with *Terebratula trilineata*. Towards the top is a rich shell-bed, full of *Nerinæa cingenda* and many other fossils, which probably represents a low part of the *Murchisonæ*-zone. Most of the shells are now converted into spathic iron, having a thin coating of oxide.

The Lower Estuarine series, which succeeds the Dogger, is well developed at the Peak, where it constitutes the bulk of the cliffs in successive tiers of Sandstone parted by layers of Shale. A dark Shaly bed containing abundance of a species of *Trigonia* is often conspicuous —the Ellerbeck bed of the Survey. There is but a partial development of the Millepore Rock in these cliffs, so that the Middle Estuarine can scarcely be said to be separated from the Lower Estuarine. Towards the upper edge of the cliff face, the 'trod' by which it is possible to ascend is seen to cross some shaly beds which contain fossils of the Scarborough or Grey Limestone series, and this group of beds crops out in the fields a little to the north-east of the Peak railway station.

Botany.

Mr. Thomas Newbitt, of Whitby, writes :—The northern slopes of the Peak have not yet, so far as I am aware, been fully explored by any botanist, and consequently our explorers may meet with some rarities ; but it must be admitted that the district is usually considered a somewhat unpromising field. The hills are too low for Montane species, and little woodland exists. The present season, too, is very backward. The neighbourhood is 'richest in ericetal and sylvestral flowering plants and mosses which affect low hilly districts' ('North Yorkshire.'). On, or near the edge of, the moors may be found *Scirpus pauciflorus*, *Tormentilla reptans*, *Gnaphalium dioicum*, *Pedicularis sylvatica*, *Ulex Gallii*, and *U. europæus*, and in the damper spots *Eriophorum vaginatum*, *Drosera*, long and round-leaved, *Pinguicula vulgaris*, &c. The cliffs facing the sea are also disappoint-

ing, but *Parnassia palustris*, *Cochlearia officinalis*, &c., may be found there. The woody dells contain *Sanicula europæea*, *Teucrium scorodonia*, *Spiræa ulmaria*, *Angelica sylvestris*, *Fragaria vesca*, *Lactuca muralis*. In Ramsdale Wood and Mill Beck a nice variety of mosses may be looked for.

The Rev. W. C. Hey notes that near the Peak grow *Vicia sylvatica*, *Solidago virgaurea*, *Erythræa centaurium*; on the moors, *Corydalis claviculata*, *Habenaria bifolia*, *Gentiana campestris*, *Pedicularis sylvatica*, *Malva moschata*, *Narthecium ossifragum*; and in the wooded valley, *Epipactis palustris*, *Myrrhis odorata*, *Asperula odorata*.

Entomology.

Mr. J. T. Sewell, of Whitby, has taken *Tephrosia biundularia*, *Spilodes palealis*, and *Aplecta occulta* at sugar, and the Rev. W. C. Hey states that of beetles, *Olisthopus rotundatus* is the best he has taken. *Cicindela campestris* swarms on the moors, and this year *Vanessa cardui* was in profusion.

Conchology.

Mr. W. Denison Roebuck writes:—The little valleys which intersect Robin Hood's Bay are likely to be most productive: the Ramsdale and Mill Beck Valley this year produced *Limax cinereo-niger*, as well as the commoner slugs, and *Clausilia laminata*, *Helix arbustorum*, *H. hortensis* and several other shells occur there as well. The mud-cliffs produce *Succinea elegans*, *Limnæa truncatula*, and *Pisidium pusillum* in the usual moist places.

Water Shells are few in number.

Of Marine Shell, the Rev. W. C. Hey notes that the red variety of *Littorina littorea* abounds on the shore.

Vertebrate Zoology.

Mr. W. Cecil Scott writes:—This district does not appear to have received much attention from Ornithologists, but during the time I was there arranging for this excursion I noticed in addition to the more common birds, the Herring Gull and the Lesser Black-backed Gull (the former breeding very freely on the cliffs at Castle Chamber, in company with the Jackdaws and House Martins). The Wheatear Common Bunting, Cuckoo, and Dipper I saw near Ramsdale Beck. My time in the district being very short I had not an opportunity of making further observations. Mr. Edgar R. Waite informs me that he has seen Cormorants in the Bay.

Programme of Meetings.

4-56.—Train leaves Robin Hood's Bay Station for Scarborough.
5-45.—Meat Tea, 2/- each, Bearup's Station Hotel, Scarborough (entrance from the Railway Platform).
6-30.—Sectional Meetings } Museum, Scarborough.
7- 0.—General Meeting }
8- 0.—Departure of Train from Scarborough Station.

Yorkshire Naturalists' Union.

President:

WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S., Oatlands Park, Weybridge, Surrey.

Ex-Presidents:

Rev. Wm. Fowler, M.A., Liversedge.
H. Clifton Sorby, LL.D, F.R.S., etc., Sheffield.
Prof. W. C. Williamson, LL.D., F.R.S., Manchester.
John Gilbert Baker, F.R.S., F.L.S., Kew.
Rt. Hon. Lord Walsingham, M.A., F.R.S., Thetford, Norfolk.
Rev. W. H. Dallinger, LL.D., F.R.S., Pres.R.M.S., Sheffield.
Sir Ralph Payne-Gallwey, Bart., M.B.O.U., Thirkleby Park.

Secretaries:

Wm. Denison Roebuck, F.L.S., Sunny Bank, Leeds.
Wm. Eagle Clarke, F.L.S., Museum, Edinburgh.

THE SEVENTY-FIFTH MEETING

WILL BE HELD AT

MARKET WEIGHTON,

FOR THE INVESTIGATION OF

Goodmanham, Londesborough Park, and the Edge of the Wolds,

On Bank Holiday Monday, Aug. 6th, 1888.

Permission has been kindly given by the Rt. Hon. the Earl of Londesborough for members to visit his estates.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Market Weighton to Members and Associates of the Y.N.U. producing their signed card of Membershp.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination ; the reduction of fare will be granted for both portions of the journey.

Routes.

Route I.—Geological.—The Rev. E. Maule Cole, M.A., will conduct a party to Goodmanham, Euthorpe, and perhaps Londesborough, starting from Market Weighton Station at 11 a.m.

Route II.—Mr. Boyes will lead a party starting from Market Weighton along the Sancton-road as far as the Grange, then down the road to Houghton and the bulrush ponds near the presbytery, then through the park on to the moor and north cliff woods.

Books and Maps.

The district will be found upon the One-inch Ordnance Map, sheet 72 (formerly 94 S.W.), of which the 'Drift' edition of the Geological Map is also published. Reference can also be made to Tate and Blake's 'Yorkshire Lias.'

Physical Geography and Geology.

The Rev. E. Maule Cole, M.A., writes:—It was hoped at one time that the new railway, now in process of construction, from Market Weighton to Driffield would afford some new and valuable sections of the beds underlying the chalk at the former locality. Such, however, is not the case. There is a very deep cutting (70 feet) in the Middle Chalk (chalk with flints) at Euthorpe, which does not reach the Grey Chalk, and the material excavated is used to form an embankment in the dale bottom approaching Market Weighton, covering up former exposures instead of revealing new ones.

The town of Market Weighton is built partly on the Keuper Marls of the New Red Sandstone, and partly on beds of Lower Lias. The four Ammonite Zones of the Lower Lias, viz.: *planorbis*, *angulatus*, *bucklandi*, and *oxynotus*, are all present in the neighbourhood, though difficult to find at Market Weighton; typical sections of the two former can be seen at North Cliff (three miles).

The zone of *A. planorbis* furnishes the *pleuromya* limestones, and bands of *Ostræa liassica*; that of *A. angulatus* the numerous 'grey stones' lying on the surface of the fields, generally fossiliferous; that of *A. bucklandi* the ubiquitous *Gryphæa incurva* or *arcuata*, as now called; whilst *A. oxynotus* is famous for its belemnites.

The Lower Oolites, which disappear at Hanging Grimston, save for patches at Kirby Underdale and Grimthorpe, re-appear from under the chalk half-way between Market Weighton and Sancton, at which latter place, close to the church (north-east corner), there is a good exposure of white Kellaways sandstone.

The water supply of Market Weighton is drawn from the chalk, from springs which issue at the junction of the Red Chalk with the Lower Lias. Between Market Weighton and Londesborough the tea-green shales of the Rhætic beds may be found in the streams and ditches. At Bielbecks, near Market Weighton, remains of extinct mammals, *Elephas primigenius*, *Rhinoceros tichorhinus*, &c., probably belonging to late glacial times, were found in a marl pit some forty years ago, and may be correlated with the mammoth remains recently found in gravel at Elloughton.

Botanology.

The district to be investigated was, practically, terra incognita previous to the visit of the Union on Sept. 4th, 1880, and little, if anything, of importance has been reported from the neighbourhood since, probably from lack of resident workers. The flowering plants known to occur may be roughly divided into those typical of dry calcareous and moister arenaceous soils. To the east of Weighton,

up on the chalky wold, and in the thickets of the hollows *Reseda lutea*, *Bryonia dioica*, *Scabiosa columbaria*, *Inula conyza*, *Carduus eriophorus*, *Cichorium*, *Erigeron acris*, *Campanula glomerata*, *Chlora*, *Ligustrum*, *Gentiana Amarella*, *Verbena*, *Salvia verbenaca*, *Calamintha clinopodium*, *Ophrys apifera*, *Gymnadenia*, *Spiranthes autumnalis*, *Bromus arvensis*, *Avena pubescens*, and *Hordeum sylvaticum* (?) are on record; whilst on the sandy moors, in the fir woods, and low marshy ground by the Market Weighton Canal, to the west and south of the town, the following species are known to have been found: *Hypericum humifusum*, *Saponaria*, *Silene anglica*, *Rosa mollis*, *Pulicaria dysenterica*, *Chrysanthemum segetum*, *Jasione montana*, *Pimpinella saxifraga*, *Menyanthes*, *Parnassia*, *Pedicularis palustris*, *Anagallis tenella*, *Nepeta cataria*, *Orchis incarnata*, and *Carex pallescens*.

Some localities, sandy commons and fir woods, were said in the former circular to yield good cryptogams, the aduncoid *Hypni*, *Cryphæa*, and Iceland Moss (*Cetraria*) being named; but the report of the meeting enumerated nothing rarer than *Plagiothecium undulatum* as having been actually gathered.

The neighbourhood will undoubtedly (a little later) produce a rich harvest of the larger Agarics. On this occasion, perhaps, it will be most useful for botanologists to keep a special look out for certain species of Phanerogams as yet *un*recorded for this part of East Yorkshire, but some of which, perhaps several, are almost certain to occur. These are: in sandy arable land, *Euphorbia platyphylla*, *Rhinanthus major*, and *Galeopsis ochroleuca*; in chalky pasture turf, *Spiræa filipendula*, *Carduus acaulis*, *Linum perenne*; in calcareous corn-fields, *Galium tricorne*, *Linaria elatine*, *Antirrhinum orontium*; in sandy turf, *Dianthus deltoides* and *Potentilla argentea*; in chalky lanes, *Clematis*, *Rosa rubiginosa*, and *Cynoglossum officinale*; in sandy places, *Turritis glabra*, *Linaria repens*, and *Arctium majus*; and in peat, *Scutellaria minor*, *Aira uliginosa*, and *Lycopodium inundatum*. A few of these may be confidently expected to reward searchers who do not attempt to cover too much ground: a limited area, well gone over, always yields the best results to the botanist, whether phanero- or cryptogamic.

Entomology.

The neighbourhood of Market Weighton is not at present favoured by students in this branch of natural history, consequently the district will present a good field for original workers. The Rev. F. O. Morris, B.A., of Nunburnholme, states that he once took *Pyrausta punicealis* at Drewton, Market Weighton, and that *Satyrus Semele* has also been taken near there.

Conchology.

Mr. J. Darker Butterell gives the following list: *S. corneum*, Bubwith and Breighton; *Unio tumidus* and *U. pictorum*, Market Weighton canal, between Newport and Cliff; *Bythinia tentaculata*, Londesborough and Breighton; *B. leachii*, Bubwith; *Planorbis albus*, Lon-

desborough; *P. spirorbis*, Breighton; *P. vortex*, Bubwith; *P. corneus*, Breighton; *Physa fontinalis* and *Limnæa peregra*, Londesborough; *L. stagnalis*, Breighton; *Zonites crystallinus*, Londesborough; and he adds that the wetness of the present season is favourable to adding materially to the list of land shells, of which very few were observed on the occasion of the Union's previous visit to the same ground on a very sultry day in 1880.

Vertebrate Zoology.

Mr. F. Boyes writes:—Some portions of the district to be visited have lost much of their interest since the introduction of the steam plough, and many hundreds of acres of peaty moorland and sandy desert-like areas have been changed into cornfields, thereby considerably altering the character of their fauna and flora. The large Rabbit warrens (at one time the summer-house of the Stone Plover, the Redshank, the Snipe, and the Peewit, as well as the Nightjar and numbers of Stock Doves, which latter nested in the Rabbit holes), have now become almost deserted by these birds, and the ground is now tenanted by the ordinary well-known denizens of cultivated districts. To the same cause is attributable the disappearance of the Lizard, the Adder, and numerous other creatures peculiar to similar unreclaimed oasises, but it is amongst the insects where the greatest change has been effected; it was there where our rarest species were formerly to be found, now almost deserted by them in consequence of the alteration of flora. But though we regret the loss of so much that is peculiar and interesting there still remains a fauna well worth searching for and investigating, amongst which may be mentioned the Crossbill, Jay, Magpie, Nightjar, Heron, Turtle Dove, Woodpeckers (Green and Great Spotted), Stock Dove, Wood Wren, and probably Stone Curlew, but by far the most attractive bird likely to be seen is the Sand Grouse, which at present is within the district to be visited in large numbers, though somewhat erratic in its movements from place to place.

Micro-Zoology and Botany.

No attention appears to have been paid to this branch of research, and it is to be hoped that microscopists will avail themselves of the opportunity for investigation.

Programme of Meetings.

5-45.—Meat Tea, 2/- each, at Londesborough Arms Hotel, Market Weighton.

6-30.—Sectional Meetings } At the Church (Girls') School, one min-
7- 0.—General Meeting } ute's walk from the railway station.

8-14.—Departure of Train from Market Weighton Station.

Yorkshire Naturalists' Union.

President:
HENRY EELES DRESSER, F.L.S., F.Z.S., London.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

Hon. Assistant Secretaries:
PERCY H. GRIMSHAW, 8, Elm Grove, Burley-in-Wharfedale.
EDGAR R. WAITE, Philosophical Hall, Leeds.

THE SEVENTY-EIGHTH MEETING

WILL BE HELD AT

HUDDERSFIELD,

FOR THE INVESTIGATION OF THE

HOLMFIRTH DISTRICT,

ON

WHIT-MONDAY, JUNE 10th, 1889.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Huddersfield and Holmfirth, to Members and Associates of the Y.N.U. producing their signed card of Membership.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

Permission is kindly granted by Mr. F. R. Jones for members to visit Harden Moss.

I. (GEOLOGICAL). Leave Holmfirth at 10-50 a.m., and proceed by Holmbridge to Bilberry Reservoir; thence across to Ramsden Edge, and back to Holmfirth in time for the 4-50 p.m. train to Huddersfield.

II. Leave Holmfirth at 10.50 a.m., proceeding by Holmbridge to Bilberry Reservoir and thence to Harden Moss, returning to Holmfirth in time for the 4-50 p.m. train to Huddersfield.

The various parties will be in charge of Messrs. J. Carter, A. Clarke, C. P. Hobkirk, F.L.S., S. L. Mosley, F.E.S., G. T. Porritt, F.L.S., T. W. Woodhead, &c.

Books and Maps.

The whole district is comprised in Sheet 88 S.E. of the One-inch and Sheet 272 of the Six-inch Ordnance Maps. These are published geologically coloured. For further information see Hobkirk's Nat. Hist. of Huddersfield (ed. 1, 1859 and ed. 2, 1868) for full lists of

fauna and flora; also Whitwam's List of Shells (Nat., May and June, 1877, pp. 151 and 167); Porritt and Mosley's 'Lepidoptera of Huddersfield' (Hudd. Nat. Soc., 1883), price 1/-; Whitwam's 'Mollusca' and Mosley's 'Reptilia of Huddersfield' (do., 1884), price 6d.

Physical Geography and Geology.

Mr. C. H. Bould sends the following:—Holmfirth lies in a narrow valley on the eastern slope of the Pennine Range, on the Millstone Grit series of rocks, all of which are well developed in the neighbourhood. The River Holme, a tributary of the Colne, drains the valley and is fed by numerous small streams from the high moorlands around. The Millstone Grit series are regarded as shore deposits with marine intercalations, and are divided into four divisions, which in West Yorkshire have a thickness of 2,000 to 3,000 ft. The Kinderscout, the lowest bed, forms the high moorlands of Birchenbank Moss, Featherbed Moor, Harden Moor, &c., and is divided into two or three beds of very coarse grit stones and shales, and attains a thickness of about 700 ft. The third grits lie immediately above the Kinderscout and consist of gritstone, flagstone, shale and thin seams of coal; a very good section of these rocks is seen in Ramsden Clough; they attain a thickness of 400 to 500 ft. The uppermost bed forms the level ridge bounding Holme Moss, Black Moss, Withern Edge and Ramsden Edge. Above the third grits and separated by about 100 ft. of shale, are the second or flagstone grits of Cook's Study and Snailsden Pike End. The rough rock or highest bed of the Millstone Grit occupies the tract of Scholes Moor to Holmfirth (the Boshaw reservoir is situated on this rock) and continues in an almost unbroken line to Huddersfield, where it disappears beneath the coal measures. Ascending the valley of the Holme, the river bed is cut through the third grits, at Holmbridge the Kinderscout appears and on one of its beds the Bilberry reservoir is situated. The Kinderscout conglomerate occupies the tract of Good Bent, and is seen in Marsden Clough, &c. At Harden Moss the rough rock is well developed, and near the Ford Inn a bed of coal is seen. From Holmbridge to the left in Ramsden Clough the third grits may be examined, the escarpment round the upper part of the Clough being composed of a massive, well-jointed, thick sandstone, in many places of a red colour but turning to white on exposure.

Botany.

Mr. T. W. Woodhead furnishes the following notes:—The districts of Bilberry and Holme have not been much visited, but though rather early in the season, many good finds may be expected. *Viola lutea* and *Menyanthes trifoliata* have been found near the reservoir and search should be made for them. Among others may be mentioned *Polygala vulgaris* (with blue, pink and white flowers), *Drosera rotundifolia*, *Ornithopus perpusillus*, *Arctostaphylos uva-ursi*, (Holme) *Empetrum nigrum*, *Scolopendrium vulgare*, *Cystopteris fragilis* (recorded for Ramsden Rocks), and *Lycopodium selago*. At Harden Moss the following occur:—*Vaccinium oxycoccus*, *V. vitis-idæa*, *V. uliginosa* (Harden Clough), *Andromeda polifolia*, *Rubus chamæmorus*, *Agrostis canina*, *Milium effusum*, *Festuca sciuroides*, *Lomaria spicant*, *Nephrodium oreopteris*, *Polypodium vulgare*, *P.*

phegopteris, *P. dryopteris*, and in the hilly pastures, *Ophioglossum vulgatum* and *Botrychium lunaria*.

Mr. C. P. Hobkirk, F.L.S., states that no specific list of Mosses of the Holme Valley and the hills above appears to have been compiled. It would therefore be advisable to note all the species observed during the excursion. Amongst those already on record from the upper valley of the Colne which may also possibly turn up in similar situations in the Holme may be mentioned:—Of *Sphagnum* several species on the moors and moorland valleys, as *acutifolium*, *squarrosum*, *intermedium*, *subsecundum*, &c., *Weissia viridula* frequent, *Dichodontium pellucidum*, *Dicranella squarrosa* (Harden Moss), *Brachydontium trichodes* (Holme Moss), *Phascum bryoides*, *Didymodon rubellus*, *Racomitrium heterostichum* (found on the Marsden Range and should be looked for), *Splachnum sphæricum* (Holme Moss), *Philonotis fontana*, *Bryum pseudo-triquetrum* (Slaithwaite) *Mnium hornum*, *Tetrodontium brownianum* (Harden Moss), *Hyocomium flagellare* (Wessenden), *Hypnum vernicosum* (Slaithwaite), *H. patientiæ* (Thurstonland), *H. ochraceum* and *H. cordifolium* (Saddleworth, should both be looked for); *Hylocomium loreum* and *H. squarrosum*.

Entomology.

Mr. G. T. Porritt, F.L.S., F.E.S., writes as follows:—The district for investigation should prove rich entomologically, including as it does, so much of both moorland and woodland. Of Lepidoptera may be expected the following:—Imagines: *Hepialus hectus*, *Notodonta camelina* and *N. dromedarius*, *Acronycta menyanthidis* and *A. rumicis* var. *salicis*, *Chortodes arcuosa*, *Xylophasia rurea* (fine vars.), *Mamestra anceps*, *Apamea basilinea* (richly marked forms), *A. gemina* (vars.) *Hadena adusta* and *H. glauca*, *Anarta myrtilli*, *Amphydasis betularia* var. *doubledayaria*, *Acidalia fumata*, *Fidonia piniaria*, *Emmelesia albulata* and *E. decolorata*, *Melanippe galiata*, and many good Tortrices and Tineæ. Larvæ of the following may also be looked for:—*Cymatophora flavicornis*, *Trachea piniperda*, *Orthosia suspecta* (this should be specially worked for by beating birches in the woods) *Xanthia cerago* and *X. silago*, *Polia chi* and *P. flavocincta* (for dark vars.), *Epunda viminalis* (the imagines bred from this district are very black, and are the var. *obscura*), *Calocampa exoleta*, *Plusia iota* and *P. v-aureum*, *Himera pennaria*, *Nyssia hispidaria*, *Acidalia inornata*, *Agrotis agathina*, *Cheimatobia boreata*, *Oporabia filigrammaria*, *Larentia cæsiata*, *Hypsipetes elutata*, for moorland forms, &c.

Neuropterists and Trichopterists may reasonably expect to meet with the following:—*Chrysoperla grammatica*, *Isopteryx burmeisteri*, *Leuctra fusciventris* and *L. nigra*, *Nemoura variegata*, *N. meyeri* and *N. cinerea*, *Sialis lutaria* and *S. fuliginosa*, *Raphidia notata* and *R. xanthostigma*, *Micromus paganus*, *Hemerobius nitidulus* (among firs), *H. micans*, *H. humuli*, *H. orotypus*, *H. limbatus*, and *H. subnebulosus*, *Chrysopa flava*, *C. vittata*, *C. alba*, *C. flavifrous*, *C. tenella* (the best British species), *C. ventralis*, and *C. perla*, *Panorpa communis* and *P. germanica*, *Phryganea grandis* and *P. striata*, *Limnophilus centralis*, *L. vittatus*, *L. affinis*, and *L. sparsus*, *Asynarchus cœnosus* (larvæ in the wet pools on the moors), *Stenophylax stellatus* and *S. latipennis*, *Microp-*

terna sequax, *Drusus annulatus*, *Berœa pullata*, *Hydropsyche guttata*, *Wormaldia occipitalis*, *Plectrocnemia conspersa*, &c. I shall be greatly obliged to members who take doubtful specimens in the orders Lepidoptera, Neuroptera, Trichoptera, and Orthoptera, if they will kindly submit them to me for determination or verification.

Mr. S. L. Mosley, F.E.S., states that of Coleoptera the best captures he has to report are *Pterostichus parumpunctatus*, *Anchomenus junceus*, *Calathus melanocephalus* v. *nubigena*, *Bradycellus cognatus* (common), and *Aphodius tessulatus* (common).

Conchology.

Mr. Wm. Nelson, M.C.S., states that this neighbourhood has been most assiduously worked by the local conchologists, and, the usual result of good work, a good list has been produced. Though there is a scarcity of the weedy ponds so common in the lower-lying districts, yet some twenty species of water shells have been placed on record, none of which, however, demand special mention. Of Slugs there are six, amongst which is *Limax lævis*. Of Land Shells there are thirty-two recorded, a goodly number when the almost total absence of the larger and the limestone species is remembered. When we come to the small horny-coloured forms which haunt damp woods the Huddersfield district must be regarded as of remarkable interest. *Zonites radiatulus* and its variety, *Z. excavatus* and var. *vitrina*, *Helix lamellata*, that gem among British Helices, whose beauty is greatly enhanced when seen alive in its native habitats, *H. fusca*, and *H. pygmæa* all occur, while of the genus *Vertigo*, *substriata* may be mentioned, and *Acme lineata* has been taken in some numbers, along with a reversed specimen. For a full list of shells taken see list in 'Naturalist,' 1877, by J. Whitwham.

Vertebrate Zoology.

Mr. S. L. Mosley F.E.S., writes that the Dunlin may be looked for about Bilberry Reservoir; he has seen it during the breeding season at some sheets of water not far distant. The Ring Ouzel breeds commonly on the high grounds above Holmfirth. The Grasshopper Warbler is common, but the Honey Buzzard, Pied Flycatcher, Nightingale, and Fire Crest have but rarely occurred. The Red-backed Shrike and Dipper occasionally breed in the district, as did also the Swift, but it has not done so of recent years.

The most noticeable Mammal is the Black or Water Shrew, which Mr. Porritt has seen near Mollicar Wood.

Micro-Zoology and Micro-Botany.

There appears to be no information under this heading.

Programme of Meetings.

5·15 p.m.—Meat Tea, 1/9 each, at the Y.M.C.A. Restaurant.
6- 0 p.m.—Sectional Meetings } At the Y.M.C.A. Rooms.
6-30 p.m.—General Meeting }

Yorkshire Naturalists' Union.

President:
HENRY EELES DRESSER, F.L.S., F.Z.S., London.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

THE SEVENTY-NINTH MEETING

WILL BE HELD AT

WHITBY,

FOR THE INVESTIGATION OF

THE PEAK, or SOUTH CHEEK

OF

ROBIN HOOD'S BAY,

On FRIDAY, JUNE 21st, 1889.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire railway stations to Members and Associates producing their signed card of Membership.

From N.E. stations the bookings may be to Fyling Hall or Peak with liberty to break the homeward journey at Whitby, or to Whitby viâ Scarborough with liberty to break the outward journey at Fyling Hall or Peak; in both cases returning from Whitby either direct or viâ Grosmont.

On the G. N., L. & Y., L. & N. W., M. S. & L., and Mid. Railways, the bookings will be only to Whitby viâ Scarborough with liberty to break journey at Fyling Hall or Peak, and to return from Whitby viâ Grosmont.

Routes.

Permission is kindly granted by Sir Charles Strickland and Mr. A. Marshall for their property to be visited.

ROUTE I.—GEOLOGICAL.—Led by Mr. W. H. Hudleston, M.A., F.R.S., starting from Peak Station, on arrival of 11-6 a.m. train, proceeding in the direction of Crag Hall Quarry, and thence returning by the same route for a short distance, proceeding to where the Peak fault is seen in the cliff, descending to the shore, passing over Blue Wyke Point, and re-ascending cliffs by path underneath the station.

ROUTE II.—Zoologists and Botanists might work Ramsdale Woods and the Mill Beck Valley (from Fyling Hall Station), or the undercliff close to Peak Station (leader, Mr. J. H. Rowntree).

ROUTE III.—Major Woodall has kindly placed his steam-launch and trawl at the disposal of the Yorkshire Marine Zoology Committee. The launch will leave Scarborough soon after 10-30 a.m., and land Members at Whitby in time for the tea and meetings. Members and Associates willing to assist in the work of this route are requested to communicate with Mr. Percy Davis, Chevinedge, Halifax, Hon. Sec. to the Committee. Members for this route must book to Whitby viâ Scarborough with liberty to break journey at Scarborough.

ROUTE IV.—Marine Zoologists and Botanists will find the tide suitably low during the excursion, high water being at 7-10 p.m.

Books and Maps.

The whole district is comprised in Sheet 95 N.W. of the One-inch (and Sheet 47 of the Six-inch) Ordnance Map, which may also be had geologically coloured. Tate and Blake's 'Yorkshire Lias'—which gives sections of Robin Hood's Bay—is the chief authority; see also the Geological Survey Memoirs, Baker's 'North Yorkshire,' Phillips' 'Geology of the Yorkshire Coast,' and 'The Yorkshire Oolites' (Proc. Geol. Assoc., Vol. iii, No. 7). 'The Naturalist' for Aug. and Sep., 1888, pp. 239 and 265, contains much information on Botany, in the form of lists (including flowering plants, mosses, and hepatics), by M. B. Slater, F.L.S. and Prof. C. C. Babington, M.A., F.R.S.

Physical Geography and Geology.

Mr. W. H. Hudleston states that this excursion affords a favourable opportunity for the study of portions of the Lias and Inferior Oolite. Many of the zones of the Lower Lias are well displayed in the scars uncovered at low water, which conform more or less to the general curve of the Bay, of which the Peak forms the 'South Cheek. According to the Geological Survey mapping the effect of the Peak fault on these scars is to throw the beds of the zones of *Am. armatus* and *Am. oxynotus* against the *margaritatus*-beds of the Middle Lias, which latter constitute a projecting tongue of rock enclosed within a fork of the fault. The frontispiece to Young and Bird's 'Geol. Survey of the Yorks. Coast' represents 'a view of the remarkable break in the strata at Peak' as seen from this projecting tongue of rock, which may be said to separate Robin Hood's Bay from Blue Wyke Bay.

In the cliff itself the effect of this great fault is to bring the Middle Lias into juxtaposition with the Lower Estuarine Series of the Inferior Oolite, the beds on the down-throw side curving towards it, but ultimately assuming a strong dip in the opposite direction, i.e., S.E. Peak Hill, about 600 feet in elevation, is in great measure the result of this fine stratigraphical feature. It thus possesses a certain resemblance to Scarborough Castle Hill, whose northern precipice is due to a fault having a similar direction. But in the case of the Castle Hill a cross fault has helped to wedge out the entire mass from the adjacent country, which is not so at the Peak. In each case the hill is on the down-throw side, but the removal of the up-throw side at the Peak has been less complete than at Scarborough. The throw of the Peak fault is about 400 feet.

The summit cutting of the railway does not show a section of the fault, but its effects are seen on the down-throw side by the strong curve in the beds of the Middle Estuarine, whilst a short distance towards the north, the 'alum shale' or *communis*-beds are observed in the next cutting. An interesting section in the old alum quarry close by (Crag Hall) displays the 'alum shale' surmounted by the Dogger, *here only four feet thick*, which is succeeded by the Lower Shale and Sandstone (Lower Estuarine). A peculiar feature in connection with the development of the Jurassic rocks of this district is the attenuation of the Dogger and carrying Sandrock, the total absence of the *striatulus*- or *jurensis*-beds, and a probable loss of a portion of the *communis*-beds, all of which are seen to be largely developed on the down-throw side of the fault in the Peak, not quite half-a-mile distant.

From the Peak to Blue Wyke Point that portion of the cliffs which faces the sea presents a noble series of precipices, of which the 'alum shale' at first constitutes the base, succeeded by the *jurensis*-beds, not developed elsewhere in this part of Yorkshire—then the Grey Sandrock of the Dogger (*Lingula* bed), the Yellow Sandrock, and lastly, the true Dogger. Owing to the strong S.E. dip, these beds plunge one after another beneath the sea.

The Grey Sandrock of the Dogger constitutes the little platform of Blue Wyke Point, being harder than the *striatulus* beds below, out of which Blue Wyke has been excavated, and also harder than the Yellow Sandrock above, which has been eaten back to the very base of the cliff. Continuing in the direction of the dip (S.E.) the true Dogger is seen to approach the shore line, where it may be conveniently studied before plunging, in its turn, beneath the sea. The Dogger, as developed in the Peak cliffs and at Blue Wyke Point, exceeds 30 ft. in thickness. It is a chocolate-coloured Sandstone, often somewhat marly, and has a variable charge of iron, in places losing somewhat of its sandy character and becoming oolitic. The upper beds are probably the most rich in iron, which occurs partly as carbonate. It has never been worked here. The Dogger at this place is remarkable for a number of Nodular beds, the lowest of which is often charged with *Terebratula trilineata*. Towards the top is a rich shell-bed, full of *Nerinæa cingenda* and many other fossils, which probably represents a low part of the *murchisonæ*-zone. Most of the shells are now converted into spathic iron, having a thin coating of oxide.

The Lower Estuarine series, which succeeds the Dogger, is well developed at the Peak, where it constitutes the bulk of the cliffs in successive tiers of Sandstone parted by layers of Shale. A dark Shaly bed containing abundance of a species of *Trigonia* is often conspicuous —the Ellerbeck bed of the Survey. There is but a partial development of the Millepore Rock in these cliffs, so that the Middle Estuarine can scarcely be said to be separated from the Lower Estuarine. Towards the upper edge of the cliff face, the 'trod' by which it is possible to ascend is seen to cross some shaly beds which contain fossils of the Scarborough or Grey Limestone series, and this group of beds crops out in fields a little to the north-east of Peak Station.

Botany.

Mr. Thomas Newbitt, of Whitby, writes that the northern slopes of the Peak have not yet, so far as he is aware, been fully explored by any botanist, and consequently our explorers may meet with some rarities; but it must be admitted that the district is usually considered a somewhat unpromising field. The hills are too low for Montane species, and little woodland exists. The neighbourhood is 'richest in ericetal and sylvestral flowering plants and mosses which affect low hilly districts' ('North Yorkshire'). On, or near the edge of, the moors may be found *Scirpus pauciflorus*, *Tormentilla reptans*, *Gnaphalium dioicum*, *Pedicularis sylvatica*, *Ulex gallii*, and *U. europæus*, and in the damper spots *Eriophorum vaginatum*, *Drosera*, long and round-leaved, *Pinguicula vulgaris*, etc. The cliffs facing the sea are also disappointing, but *Parnassia palustris*, *Cochlearia officinalis*, etc., may be found there. The woody dells contain *Sanicula europæa*, *Teucrium scorodonia*, *Spiræa ulmaria*, *Angelica sylvestris*, *Fragaria vesca*,

Lactuca muralis. In Ramsdale Wood and Mill Beck a nice variety of mosses may be looked for.

The Rev. W. C. Hey notes that near the Peak grow *Vicia sylvatica*, *Solidago virgaurea*, *Erythræa centaurium;* on the moors, *Corydalis claviculata*, *Habenaria bifolia*, *Gentiana campestris*, *Pedicularis sylvatica*, *Malva moschata*, *Narthecium ossifragum;* and in the wooded valleys, *Epipactis palustris*, *Myrrhis odorata*, *Asperula odorata.*

Two full lists of plants were published in the 'Naturalist' for 1888, one by Mr. Slater and one by Prof. Babington, which should be referred to; and Mr. Slater informs me that two mosses—*Grimmia decipicus* Lindb., and *Bryum alpinum* var. *meridionale* Schp.—have been since recorded.

Entomology.

Mr. J. H. Rowntree considers that the best locality to visit is the undercliff close to Peak Station, where such species as *Zygæna loniceræ*, *Strenia clathrata*, *Heliothis marginata* (larvæ on restharrow), *Toxocampa pastinum*, *Euclidia mi* and *E. glyphica* are not unlikely to occur, and he will guide a party of Entomologists. The only insects actually recorded for Robin Hood's Bay are *Tephrosia biundularia*, *Spilodes palealis* and *Aplecta occulta* (all taken at sugar by Mr. J. T. Sewell), *Vanessa cardui*, and of beetles *Olisthopus rotundatus* and *Cicindela campestris*, taken by Rev. W. C. Hey.

Conchology.

Mr. W. Denison Roebuck writes that the little valleys which intersect Robin Hood's Bay are likely to be most productive; the Ramsdale and Mill Beck Valleys have produced *Limax cinereo-niger*, as well as the commoner slugs, and *Clausilia laminata*, *Helix arbustorum*, *H. hortensis* and several other shells occur there as well. The mud-cliffs produce *Succinea elegans*, *Limnæa truncatula*, and *Pisidium pusillum* in the usual moist places. The Rev. W. C. Hey has taken *Zonites radiatulus* on the cliff.

Of Marine Shells the Rev. W. C. Hey notes that the red variety of *Littorina littorea* abounds on the shore.

Vertebrate Zoology.

This district has not received much attention from Ornithologists, but Mr. W. Cecil Scott (Leeds), Mr. T. Bunker (Goole), and Mr. W. J. Clarke (Scarborough) have noted Cormorants, Herring Gulls, Rock Doves, Jackdaws, and House Martins nesting in the cliffs; the Lesser Black-backed Gull, Wheatear, Common Bunting, Cuckoo, Dipper, Magpie, Meadow Pipit, Swallow, Starling, Pied Wagtail, Sedge Warbler, Linnet, Skylark, Willow Warbler, Song Thrush, Blackbird, Partridge, Redbreast, Lapwing, Corn Crake, Yellow Bunting, Sparrow, Blackcap, Whitethroat, and Dunnock have also been noted. Of other vertebrates, only the Rabbit, Shrew, Frog, and Toad have been noted.

Micro-Zoology and Micro-Botany.

There appears to be no information under this heading.

Programme of Meetings.

3-26 p.m.—Train leaves Peak Station for Whitby.
4- 0 p.m.—Meat Tea, 2/- each
4-45 p.m.—Sectional Meetings
5- 0 p.m.—General Meeting

All at Longhorne's Station Hotel Whitby.

The chair at the General Meeting will be occupied by W. H. Hudleston, M.A., F.R.S., ex-President.

Yorkshire Naturalists' Union.

President:
HENRY EELES DRESSER, F.L.S., F.Z.S., London.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

THE EIGHTIETH MEETING

WILL BE HELD AT

HARROGATE,

FOR THE INVESTIGATION OF

RUDDING & PLUMPTON PARKS,

On SATURDAY, JULY 13th, 1889.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N.W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Harrogate, to Members and Associates of the Y.N.U. producing their signed card of Membership.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

Permission is kindly granted by Sir P. Radcliffe, Bart., for his estates to be visited.

I. Members leave Harrogate Station at 11-20 a.m. for Hookstone Wood, Crimple Valley, Rudding Park, and Plumpton Rocks—a walk of about four miles. Returning by conveyance at 4-15 p.m.

This party will be in charge of Messrs. John Farrah, Riley Fortune, John Naughton, &c.

II. (Geological only). Leaves Nidd Bridge Station at 11-57, walk viâ Ripley to Hampsthwaite and Clint, and thence to Harrogate—about eight miles' walk.

Books and Maps.

The whole district is comprised in Sheet 93 N.W. of the One-inch (also published geologically coloured) and sheets 171 and 154 of the Six-inch Ordnance Maps.

Physical Geography and Geology.

Mr. Grainge in his 'History and Topography of Harrogate and the Forest of Knaresborough' says:—The physical aspect of this district is generally that of a region of undulations, a series of hills and valleys, rounded and smoothed by the action of water. The geological formation is, generally speaking, that of the upper millstone grit, which is prominently developed at Plumpton, near Brame Hall; whilst at

Hookstones, about midway between Harrogate and Plumpton, the lower bed has been extensively quarried for building purposes. Here the stone was got for the construction of the Crimple Viaduct close by. Over all this district (except the limestones) in the regular order of geological formation, the coal measures ought to be found, as they are at some distance both on the north and south—but they are not. Instead of the coal-bearing strata, we have nothing but the millstone grit and its attendant shales. Why is it so? Have the coal-bearing beds of rock never existed, or have they been upheaved after their deposition above the surrounding district, and swept away by the action of water? The whole country round about bears marks of violent disruption and breakage; the dislocation of the strata near the Harrogate Bogs has been already mentioned, the grand fracture forming the valley of the Nidd is owing to a similar cause; besides these, a grand anticlinal axis extends from the Nidd, near Bilton Hall, westward, crosses the railway a short distance north of Starbeck, passes to the south of Harrogate, thence by way of Harlow Car, Little Almes Cliff, and Fox Crag, to the Washburn. The central ridge being elevated like the roof of a house, the strata dipping north and south on each side of it; the thick bed of gritstone has been broken, and the edges thrown at least two miles apart, where they are left standing half on edge. The north side is well developed at Birk Crag, a mile and a half north-west of Harrogate, and the south side at Hookstones, which is close to the Crimple Viaduct. This broken and rugged surface has been scoured or planed down by immense floods of water, at first in rapid motion, and afterwards a mass of clayey shale has been deposited in still water. After this period of repose, violent currents have rushed across the latter deposits, cutting through them in many places, and leaving their traces in gulleys and shallow valleys. A little to the south of the Crimple Viaduct, where the railway cuts deep into the hill, is a rock of gritstone of firm compact structure, rich in fossil stigmaria, which has much the appearance of a rock belonging to the coal measures. At Plumpton the rocks form part of the eastern edge of the Brimham or upper Millstone grit bed, which has been thrown up by the upheaval of the great anticlinal axis, which runs east and west from the setting on of the magnesian, to the mountain limestones. The broken edge of the gritstone shows most prominently from Plumpton, passing south-eastwardly by way of Brame Hall to Spofforth, where it is broken through and disappears for a short distance, to reappear at Stockeld, where it again forms the surface rock, and then finally disappears beneath the superincumbent magnesian limestone. This latter rock forms a bold and rugged escarpment on the south bank of the Nidd, called Grimbald Grag, about a mile from Plumpton in a north-easterly direction.

The rocks at Plumpton form an interesting study for the geologist and antiquary alike. They are worn into most fantastic shapes by tidal action, whilst the numerous cups and channels which are spread over their uneven surfaces, are unmistakable evidence that they have been devoted to the use of the fire-worshipper. Another very singular rock called the 'Hell Hole Rock,' is situate near the farm house called Crosper, which is not far from Brame Hall. The lake at

Plumpton is 175 feet above sea level. The rivulet named Crimple, which runs through a great portion of this district, and from which the highly picturesque valley takes its name, rises on the high land west of Beckwithshaw, and loses itself in the Nidd near Ribston Hall.

Botany.

Mr. J. Naughton and Mr. B. B. Thompson supply the following notes:—The district intended to be gone over has not been thoroughly worked, and the locality being a good one botanists may reasonably expect a treat. From Hookstones to Crimple and Plumpton the following plants have their habitats:—*Corydalis claviculata*, *Teucrium scorodonia*, *Linaria minor*, *Valeriana officinalis*, *Listera ovata*, *Sparganium ramosum*, *Malva moschata*, *Hypericum humifusum*, *Spergula arvensis*, *Aquilegia vulgaris*, *Campanula latifolia*, *Artemisia vulgaris*. In the dam at Crimple will be found *Potamogeton crispus*, *P. natans*, *Myosotis palustris*, *M. cæspitosa*, *Typha latifolia*. Near the entrance gates to Plumpton in a cottager's garden is a fine specimen of *Viscum album* growing on an apple tree. In this neighbourhood may be found *Lycopus europæus*, *Geranium pusillum*, *G. sanguineum*, *Lactuca muralis*, *Circæa lutetiana*, *Asplenium ruta-muraria*, *A. trichomanes*, *Scolopendrium vulgare*, *Equisetum limosum*, and many other interesting aquatic plants.

Entomology.

Major Ben. Blaydes Thompson states that had it not been for the records of the late Mr. John Sang of Darlington, who resided in Harrogate for about two years, little or nothing would have been known of the insect fauna of this district. It is quoted in a few instances in 'Stainton's Manual,' published in 1857. During Mr. Sang's short residence he appears to have devoted his attention to the micro-lepidoptera chiefly, and his list of captures is very extensive. The lepidoptera likely to be found are *Vanessa cardui*, *Lycæna phlæas* and *L. alsus*, *Thymele alveolus*, *Thanaos tages*, *Zygæna loniceræ*, *Nola cucullatella*, *Chelonia plantaginis*, *Pygæra bucephala*, *Notodonta dromedarius*, *Heliodes arbuti*, *Phytometra ænea*, *Cilix spinula*, *Acidalia immutata*, *Panagra petraria*, *Abraxas ulmata*, *Larentia cæsiata*, *Emmelesia decolorata*, *Coremia unidentaria*, *Tanagra chærophyllata*, besides commoner species.

In Crimple stream is to be found *Astacus fluviatilis* (Crayfish).

Conchology.

Mr. F. R. Fitzgerald thinks that the Crimple Valley will prove the best hunting ground. He has found *Zonites nitidulus*, *Z. cellarius*, *Helix hortensis*, *H. rufescens*, *H. hispida*, *H. caperata*, *H. rotundata*, *H. pygmæa*, *Pupa umbilicata*, and *Clausilia rugosa*. In the Crimple Stream have been found specimens of the largest *Planorbis albus* recorded (see 'Journ. Conch.,' Sept., 1888. and Jan., 1889, p. 21.). The *Limnæa peregra* inhabiting this stream vary very much in shape and size. The other species to be found in this stream are *Sphærium corneum*, *Pisidium amnicum*, *P. fontinale*, *P. pusillum*, *Anodonta cygnæa* (dead shells), *Planorbis corneus* and *P. complanatus* (introduced

from the Ripon canal), and *Ancylus fluviatilis*. The slugs are *Arion ater*, *A. hortensis*, and *Limax agrestis*. The pond in Rudding Park contains, in addition to some of the fore-named species, *Physa hypnorum* and *A. fluviatilis*. In the lake at Plumpton will be found *Physa fontinale*, and var. *curta*, *Anodonta cygnæa* and *A anatina*, both stunted in growth. The land shells to be found en route from Rudding to Plumpton are *Vitrina pellucida*, *Zonites cellarius*, *Z. alliarius*, *Z. nitidulus*, *Z. crystallinus*, *Helix aspersa*, and *H. nemoralis* (sparingly), *H. rotundata*, *H. pygmæa*, *H. pulchella*, *Pupa umbilicata*, *Clausilia rugosa*, *Zua lubrica*, *Carychium minimum*. Several shells should be looked for and added to this list, amongst which are one or two *Vertigoes*. For a complete list of the shells found in this district up to date see 'Journ. Conch.', Jan., 1889, pp. 18 to 31.

Vertebrate Zoology.

Mr. Riley Fortune writes that the avi-fauna of the district to be visited is very rich. He has recorded in his list over 120 species known to have visited the locality. Among the residents are, Gold-crest, Dipper, Marsh Tit, Hawfinch, Lesser Redpole, Bulfinch, Jack-daw (many curious varieties of which are found in the colony breeding in the viaducts), Crow, Great Spotted, Lesser Spotted, and Green Woodpeckers, Kingfisher, Barn, Tawny and Long-Eared Owls, Sparrowhawk, Kestrel, Wild Duck, Teal, Woodcock, Little Grebe, &c. Among the summer visitors which nest in the district are, Ringouzel Wheatear, Redstart, Lesser Whitethroat, Wood Warbler, Grass-hopper Warbler, Yellow Wagtail, Nightingale, Pied Flycatcher, Swift, Nightjar, Landrail, and Sandpiper.

The winter visitors are, Siskin, Mealy Redpole, Great Shrike, Crossbill (the latter has nested at Plumpton), Waxwing, Great Snipe, &c., while among the rarer birds the following have occurred, Raven, Hoopoe, Hen Harrier, Common and Rough Legged Buzzards, Gannet, Spotted Crake, Little Crake (said to have nested), White Winged Crossbill and Red-necked Phalarope.

The list of Mammalia includes the Noctule, Pipistrelle, Long-Eared and Whiskered Bats, Hedgehog, Mole, Shrew, Water Shrew, Fox, Weasel, Stoat, Badger (though believed now extinct), Squirrel, Dormouse, Longtailed Field Mouse, Water Vole, Field Vole, Bank Vole, Hare and Rabbit.

The Adder, Ring Snake, Lizard and Blind-worm may be found, also the common Frog and Toad, and two species of Newts.

In the lakes and stream may be found Trout, Perch, Tench, Roach, Dace, Gudgeon, Carp, Pike, Loach, Eels, Bullhead, Minnow, Stickleback, and Lampern.

Micro-Zoology and Micro-Botany.

There appears to be no information under this heading.

Programme of Meetings.

4-15 p.m.—Conveyances leave Plumpton (Fares 1/- each).

5- 0 p.m.—Meat Tea, 1/6 each
6- 0 p.m.—Sectional Meetings
6-30 p.m.—General Meeting

All at the People's Hotel, Harrogate.

Yorkshire Naturalists' Union.

President:

HENRY EELES DRESSER, F.L.S., F.Z.S., London.

Ex-Presidents:

REV. WM. FOWLER, M.A., Liversedge.
H. CLIFTON SORBY, LL.D., F.R.S., etc., Sheffield.
PROF. W. C. WILLIAMSON, LL.D., F.R.S.. Manchester.
JOHN GILBERT BAKER, F.R.S., F.L.S., Kew.
RT. HON. LORD WALSINGHAM, M.A., F.R.S., Thetford, Norfolk.
REV. W. H. DALLINGER, LL.D., F.R.S., etc., London.
SIR RALPH PAYNE-GALLWEY, Bart., M.B.O.U., Thirkleby Park.
WILFRID H. HUDLESTON, M.A., F.R.S., Weybridge.

Hon. Secretaries:

WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

Hon. Assistant Secretaries:

PERCY H. GRIMSHAW, 8, Elm Grove, Burley-in-Wharfedale.
EDGAR R. WAITE, Philosophical Hall, Leeds.

THE EIGHTY-FIRST MEETING,

TO BE HELD AT

THE HIGH FORCE INN,

On MONDAY, AUG. 5th, 1889,

WILL BE PRECEDED BY A

THREE DAYS' EXCURSION,

From SATURDAY, AUG. 3rd, to MONDAY, AUG. 5th,

FOR THE INVESTIGATION OF THE YORKSHIRE SIDE OF

UPPER TEESDALE.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G.N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Middleton-in-Teesdale, to Members and Associates of the Y.N.U. producing their signed card of Membership. Tickets taken on Saturday, August 3rd, will be available to Monday, August 5th.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and rebook to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

Permission is kindly granted by Lord Strathmore for his Teesdale property to be visited.

Books and Maps.

The whole district is comprised in Sheets 25 and 92 (new series), of the One-inch Ordnance Maps. For further information see Baker's 'North Yorkshire' (in 'Transactions of Y.N.U.,' part xii, page 128); 'The Flora of Teesdale,' 1883 (Atkinson, Market Place, Barnard Castle); 'The Musci and Hepaticæ of Teesdale,' 1844, by Richard Spruce ('Trans. Bot. Soc. Edinb.); 'Teesdale Botany,' by James Backhouse ('Nat.,' 1884, page 10); 'Notes on the Avi-Fauna of Upper Teesdale,' by James Backhouse, Junr., ('Nat.,' 1885, page 353; and 'Nat.,' 1888, page 79). Phillips' 'Rivers, Mountains, and Sea Coast of Yorkshire,' Second Edition, pp. 17, 18, 45, 51, 190. 'Geology of High Teesdale,' by Prof. Sedgwick. (Cam. Phil. Trans., 1824, Vol. II. p. 174). Discovery of Silurian beds in Teesdale (Quart. Journ. Geol. Soc., London, 1877, pp. 27—34.)

Hotel Accommodation.

As this is limited, Members who wish to take part in this excursion are advised to write to the Hotel-keepers **at least a fortnight beforehand** to secure rooms. The following prices are for bed, breakfast, tea, and attendance:—At Middleton-in-Teesdale, 'Cleveland Arms,' 5s. 6d.; 'Foresters' Arms,' King's Head,' 'Talbot,' and the Temperance Commercial Hotels, each 4s. 6d. 'High Force Inn,' five miles from Middleton, 6s. (attendance extra); 'Langdon Beck Inn,' seven miles from Middleton, 4s. Conveyances can take Members to Langdon Beck from Middleton station and back from the 'High Force Inn' for 1s. 6d. per head or 1s. each for the single journey.

☞ The Hon. Secretaries wish it to be distinctly understood that they undertake no responsibility whatever in the matter of hotel or conveyance accommodation.

Routes—Saturday, August 3rd.

On arrival at 11-28 a.m. drive in waggonettes to Langdon Beck, seven miles, walk over Widdy Bank to Cauldron Snout, cross Tees and Maize Beck, examine Cronkley Scars, and site of old Pencil Works, and follow down the river bank to the High Force; thence walk or drive to Middleton-in-Teesdale, five miles; total distance, including drive, about eighteen miles.

Or shorter route:—Drive to Langdon Beck and immediately after crossing Harwood Beck turn to the left by lime-kiln and strike the Tees at the nearest point and cross, follow the south bank, go over Cronkley Bridge and follow path which leads into the road to High Force.

In the evening Mr. J. Backhouse, jun., invites geological members to visit a bone cave in Durham, about two miles from High Force.

Monday, August 5th.

On arrival of 11-28 a.m. train, visit Whinstone Quarries, close to Middleton Station, walk up Yorkshire bank of Tees, explore Park End

Wood, a relic of the old Teesdale forest; visit Fairy Dell, examine Holwick Scars, pass Winch Bridge, said to be the oldest suspension bridge in Europe, cross Holwick Head Bridge, and proceed to the High Force, or if the river is very low continue on the Yorkshire bank and cross by the river-bed above High Force.

Members who can spare another day and are good pedestrians are strongly recommended to visit High Cup Nick, in Westmorland, and to return by way of Appleby.

As grouse shooting commences soon after the excursion, members are particularly requested to confine their observations to the valley.

Messrs. Wearmouth and Raine will accompany the parties as guides.

Physical Geography and Geology.

Major Bainbridge writes that Teesdale is traversed by a powerful fault (E. and W.) having an upthrow to the South of about 80 fathoms opposite to Middleton-in-Teesdale, which throws up the Whin Sill (Basalt) on the Yorkshire side of the Tees, forming the chief geological feature in Upper Teesdale, and contributing largely to its characteristic scenery, most prominently seen at Holwick Scars, Winch Bridge, High Force and Cauldron Snout, and at Falcon Clints and Cronkley Scars, where vast masses of Whin form a bold frontispiece at the base of Mickle Fell. Near Cronkley Scar is the site of an old Pencil Mill. Here Mr. W. Gunn and Mr. C. T. Clough, both of H.M. Geological Survey, a few years ago reported having discovered some beds of Upper Silurian Shale, underlying the Carboniferous Rocks of the Mountain Limestone Series, of special geological interest. The main considerations which led them to this conclusion were the character of the beds, the character of the dykes, the beds not being altered by the dykes, the character of the veins and the apparent unconformity between these beds and the Carboniferous beds above. Burtree-ford Dyke (N. and S.) passes near Langdon Beck, and crosses the Teesdale Fault near Cronkley, in its southward course, adding to the distortion of the strata in this locality.

Botany.

Mr. Backhouse furnishes the following notes:—A careful exploration of the country immediately adjoining the Tees on the right bank should result in the following species being observed:—*Galium boreale*, *Equisetum sylvaticum* and *E. drummondii*, *Orchis latifolia* and possibly var. *traunsteineri*, *Gymnadenia conopsea* and *G. albida*, *Polygonum viviparum*, *Bartsia alpina*, *Potentilla alpestris* and *P. fruticosa*, *Solidago virgaurea* var. *cambrica*, *Arbutus uva-ursi*, *Sedum villosum*, *Primula farinosa*, *Gentiana verna*, *Viola lutea*, *Anemone nemorosa* (up to considerable elevation here), *Pyrola minor* and *P. secunda*, *Trollius europæus*, *Listera cordata*, *Saxifraga aizoides*, *S. stellaris* and *S. hypnoides*, *Cystopteris dentata*, *Polystichum lobatum* and perhaps its variety *lonchitidioides*, *Lycopodium selago*, *L. clavatum* and *L. selaginoides*.

Entomology.

Mr. Richard Howse, Newcastle, states that *Chortobius davus* has occurred above Cauldron Snout on the Durham side, that *Bombyx callunæ* is abundant on the Yorkshire side, and that of beetles *Carabus nitens*, *Chrysomela varians*, *Lampyris noctiluca* (Glow-worm) have been observed on the Durham side, while *Carabus glabratus* (*not* recorded) is likely to occur.

Conchology.

There does not appear to have been any collecting done on the Yorkshire side, nearly all the observations made by Messrs. James Backhouse, Baker Hudson, and others, being in Durham. The most interesting record is that of *Helix fusca*, which Mr. Backhouse has found in plenty near High Force, where it should be looked for on the Yorkshire side also.

Vertebrate Zoology.

Mr. Joseph Wearmouth and Mr. J. Backhouse, Junr. write that the number of birds found, either periodically or permanently, in Upper Teesdale is considerable; but on the Yorkshire side of the Tees the variety is not nearly so great as in Durham owing to the more uniform character of the ground. A walk between High Force and Cauldron Snout should, however, produce Kestrel, Golden Plover, Lapwing, possibly Dunlin (which breeds regularly on the higher fells), Common Sandpiper, Curlew, Dipper, Ring Ousel, Redstart, Willow Warbler, Wheatear, Grey Wagtail, Meadow Pipit. From High Force down stream past Winch Bridge, Holwick and Park End Wood—the Spotted Flycatcher, Pied Wagtail, Whinchat, Tree Pipit, Chiffchaff, Garden Warbler, Grasshopper Warbler, and Rock Dove may all be observed (the latter species at Holwick) ; whilst Chaffinches will be noticed abundantly in lieu of the House Sparrow, which is decidedly scarce above Middleton-in-Teesdale.

It would be well to look out specially for Reed Sparrow, Sedge Warbler, and Stone Chat (*Pratincola rubicola*), none of which have been recorded in Upper Teesdale.

A number of scarce birds have from time to time been met with on the Yorkshire Moors, among which may be specially mentioned—Peregrine Falcon, Buzzard, Oystercatcher, Great Grey Shrike and Common Scater.

Micro-Zoology and Micro-Botany.

A rare ostracod, for which only a few British stations are known, *Cypris cinerea*, was found by Mr. Brady in a pool on Mickle Fell, 2000 feet alt. (Brady, ' Linn. Trans.' xxvi. 374).

Programme of Monday's Meetings.

4- 0 p.m.—Tea at the High Force Inn, at 2/- each.
4-30 p.m.—General Meeting.
4-45 p.m.—Conveyances leave for Middleton Station.
5-30 p.m.—Train leaves Middleton for Darlington and the South.

Yorkshire Naturalists' Union.

President:
HENRY EELES DRESSER, F.L.S., F.Z.S., London.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

THE EIGHTY-SECOND MEETING

WILL BE HELD AT

MALTON,

FOR THE INVESTIGATION OF

KIRKHAM ABBEY and ACKLAM BROW,

ON

WEDNESDAY, SEPT. 4th, 1889.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G.N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Malton or Kirkham Abbey to Members and Associates of the Y.N.U. producing their signed card of Membership. Holders of Malton tickets may break their journey at Kirkham Abbey in going, and of Kirkham Abbey tickets at Malton in returning.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and rebook to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

Permission is kindly granted by Mrs. St. Quintin for members to visit Kirkham Abbey, by Sir Charles Strickland for Howsham Woods, and by Mr. Ed. C. Taylor for Firby Woods.

I. (General). Leave Kirkham Abbey Station at 10-25 a.m. for the investigation of Kirkham Abbey, Firby, and Howsham Woods, in charge of members of the Malton Society. Returning to Malton by 3-47 p.m. train from Kirkham Abbey, or 3-56 p.m. from Huttons Ambo.

II. Leave Kirkham Abbey at 10-25 a.m., and walk to Acklam Brow, returning to Malton by conveyance at 3-45 p.m. from Leavening (fare 1/3 each), in charge of Rev. E. M. Cole and Mr. Samuel Chadwick.

Members wishing to spend a day or two previously in the district will find very good accommodation at the Malton Hotels.

Books and Maps.

The whole district is comprised in Sheet 63 (=93 N.W.) of the One-Inch (published geologically coloured) and Sheets 141, 142, 124 of the Six-Inch Ordnance Maps. For further information see Dr. Parsons' List of East Riding Mosses and Hepatics (Trans. Y.N.U., parts 2 and 4); and Phillips' Works on Yorkshire Geology.

Physical Geography and Geology.

Rev. E. Maule Cole, M.A., F.G.S., writes :—The winding gorge of the Derwent at Kirkham, with its well-wooded slopes and banks carpeted with wild flowers, forms a fitting setting to the gem of the ruined Abbey which stood in beautiful, but dignified, seclusion till modern requirements utilized the valley carved out by the river and sent a railway through the midst of this charming scenery. Certainly those old monks had an eye for the picturesque. The Abbey itself stands on the Upper Lias which is exposed by denudation as far as Castle Howard Station. Immediately above, the Dogger forms a sort of terrace. This bed, the lowest of the Inferior Oolites, is ferruginous, and at Kirkham has been worked for iron ore, but the workings have been abandoned as not sufficiently remunerative. From Kirkham to Burythorpe the surface of the country is occupied by estuarine sandstones of the Lower Oolites, with intercalated beds of limestone, Millepore and Scarborough, which may be seen in the quarries at Westow. The whole district is much faulted and presented great difficulty to the geological surveyors. In the midst is thrust up a triangular mass of Kellaways Rock, the base of the Middle Oolites. On approaching the edge of the Chalk Wolds these rocks are again met with : the Lower Calcareous Grit, resting on Oxford Clay, forming the usual Nabs which are such a distinctive feature of the Tabular Hills (one in particular, called Mount Ferrand, was selected as the site of a castle, built by the Fossards, no traces of which, however, now remain). Above the Lower Calcareous Grit the remaining beds of the Middle Oolites, Coralline Oolite, Coral Rag, etc., are absent, the slopes of the Wolds from Leavening, along Birdsall Brow, and eastwards, consisting of Kimmeridge Clay, the base of the Upper Oolites. Ascending the Wold a band of Red Chalk is next reached, the base of the Upper Cretaceous Rocks, the Lower Cretaceous being absent except for a thin band (six inches) of yellow sand with numerous small rounded pebbles which is supposed to represent the Neocomian beds. Some thirty feet of Chalk Marl and Grey Chalk succeed, after which the White Chalk with flints (Middle Chalk) is met with, which constitutes the surface of all the high ground of the Wolds on the northern and western escarpments.

At the north-west corner of the Wolds, overhanging Leavening and Acklam, on a clear day, one of the finest views in all Yorkshire may be obtained. To the right may be seen the Scarborough racecourse and the range of Tabular Hills running thence past Pickering and Helmsley to the Hambleton Hills, with the Howardians spread out in front. In the Vale of York Creyke stands out prominently on its conical hill and a little to the left the hills beyond Ripon; more to the left Harrogate and the hills behind it. Then, in the centre, the great Minster at York, towering far above the ancient Roman capital of Britain; behind it Rombalds Moor near Leeds; more to the left again, Brayton Barff, Selby Abbey, Howden Tower, Heming-

borough Spire, and so on, right away to the mouth of the Trent. It is a truly magnificent view, and all that is required is a clear day, such as commonly accompanies a northerly wind. When we consider that the Chalk Rocks not improbably extended across the large area under review, we have some idea of the vast amount of denudation which has gone on, and of the enormous lapse of time occupied simply in removing what previous countless ages had been employed in building up.

Botany.

Mr. M. B. Slater, F.L.S., supplies the following list of plants that grow in the vale of Kirkham and Derwent, and adjoining woodlands. In boggy and watery places near Kirkham Abbey Station:—*Ranunculus lingua*, *Stellaria nemorum*, *Utricularia vulgaris*, *Epipactis palustris*, *E. latifolia*, *Sium latifolium*. About the ruins of the Abbey:—*Chelidonium majus*, *Sinapis tenuifolia*, *Echium vulgare*, *Parietaria diffusa*, *Myrrhis odorata*. In Firby and Howsham Woods:—*Actæa spicata*, *Geranium phæum*, *Lathræa squamaria*, *Habenaria chlorantha*, *Convallaria majalis*. By the banks of the River Derwent and in the pastures along the valley:—*Nymphæa alba*, *Nuphar lutea*, *Hippuris vulgaris*, *Myriophyllum verticillatum*, *Lythrum salicaria*, *Senecio aquaticus*, *Mentha viridis*, *Scutellaria galericulata*, *Lysimachia vulgaris*, *Ophrys apifera*, *Colchicum autumnale*, *Sagittaria sagittifolia*, *Butomus umbellatus*, *Acorus calamus*, *Thalictrum flavum*. The following grasses by the banks of the river and the woods around:—*Phalaris arundinacea*, *Arundo phragmites*, *A. epigejos*, *Glyceria aquatica*, *G. fluitans*, *Brachypodium sylvaticum*, *Bromus giganteus*, *B. asper*, etc. The above lists of plants recorded from the Derwent Valley, many of them rarities, show that it is very good ground for botanists, more particularly in spring and early summer months, so that some interesting late summer flowering plants may be expected on the excursion.

Some rare mosses and hepatics also grow on the route; the time of year, however, is rather too early to obtain the autum-nfruiting kinds in good condition.

Entomology.

Messrs. John Ruston and C. W. L. Colby, who have collected the Lepidoptera within a 15-mile radius of Malton, have supplied lists showing that the district to be examined may be expected to yield fair results to collectors. Menethorpe Common (near Huttons Ambo Station) has been worked by Mr. Colby, who has there taken *Pieris napi*, *Pamphila sylvanus*, *P. linea*, *Anthocharis cardamines*, *Polyommatus alexis*, *Chrysophanus phlæas*, *Vanessa cardui*, *Argynnis selene*, &c. The nearly full-fed larvæ of *Euchelia jacobææ* should be found feeding on Ragwort at the date of the excursion. The district generally—well-wooded as it is—has never yet been worked. Mr. Waite has taken

Agrion puella near Firby Wood, and Mr. W. Hewitt *Polia chi*, *Cidaria immanata*, *Melanippe substristata*, *Larentia didymata*, *Melanthia rubiginata*, *Eubolia mensuraria*, *Ypsipetes elutata*, *Cosmia trapezina*, and *Cidaria pyraliata.*

Conchology.

Mr. Alfd. H. Taylor writes that the district has not as yet been worked, but that, judging from what he has found elsewhere near Malton, conchologists may expect to meet with numerous interesting species. Messrs. W. Hewitt and J. A. Wheldon have recently found *Helix arbustorum* with its vars. *flavescens* and *conoidea*, *Helix virgata* and var. *albicans*, *H. ericetorum* and varieties, *Clausilia laminata*, &c. The district being well-wooded, and the river a slowly-flowing one, careful search should be made for woodland and aquatic forms.

Vertebrate Zoology.

Messrs. A. W. Walker and T. P. Longster write: The Derwent Valley from Kirkham to Malton is particularly rich in its avifauna. In Firby Wood the Sparrow-Hawk, Kestrel, Jay, Magpie, Carrion Crow, Ring Dove, Stock Dove, Greater and Lesser Spotted and Green Woodpeckers, Barn, Tawny, and Long-eared Owls, also Tree Creeper, Nut-hatch, and probably Pied Flycatcher have all nested. The Gold crested Wren, Marsh, Long-tailed, Blue and Coal Tits, Redpole, Bullfinch, Hawfinch, Reed, Common and Yellow Buntings, Whitethroat, Wood-warbler, Chiff Chaff, Sedge-warbler, and Black cap, Redstart, Meadow and Tree Pipits, and along the river banks have been seen the Dipper, Kingfisher, Yellow, Grey, and Pied Wagtails, Land Rail, Water Rail, Moorhen, Wild Duck, Common Sandpiper, and the Great Northern Diver has also been recorded. The Ring Ouzel has also nested in Mr. Longster's garden, close to Malton.

The list of Mammalia includes, Hedgehog, Mole, Shrew, Water Shrew, Fox, Weasel, Polecat, Badger, Squirrel, Otter, Dormouse, Long Tailed Field Mouse, Water, Field and Bank Voles, Hare and Rabbit.

The Fishes of the River Derwent include Trout, Pike, Perch, Roach, Dace, Gudgeon, Eels, Ruffe, Bullhead, Lampern, Grayling, Burbot, Minnow, and Stickleback, and at Kirkham-Dam Salmon are of frequent occurrence.

The Reptiles and Amphibians are not yet on record, except Frog and Toad.

Micro-Zoology and Micro-Botany.

There appears to be no information under this heading.

Programme of Meetings.

4-15 p.m Meat Tea, 2/- each, at the Crown Hotel, Wheelgate, Malton.
5-15 p.m. Sectional Meetings } at the Literary Institute, Malton.
5-45 p.m. General Meeting }

Yorkshire Naturalists' Union.

President:
RT. REV. WM. WALSHAM HOW, D.D., LORD BISHOP OF WAKEFIELD.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

THE EIGHTY-FOURTH MEETING

WILL BE HELD AT

DRIFFIELD

FOR

LOWTHORPE,

ON

WHIT-MONDAY, 26th May, 1890.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Driffield and Lowthorpe, to Members and Associates of the Y. N. U. producing their signed card of Membership.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Routes.

The district selected for investigation is the neighbourhood of Lowthorpe, Ruston Parva, and the Valley of the Kelk Beck from Lowthorpe Station upwards to Kilham.

Permission for the investigation of their estates has been kindly granted by Mr. W. H. St. Quintin, M.B.O.U., and Mr. John Dickson.

Messrs. Davison, Mortimer, and Ross will conduct the party from Lowthorpe to Ruston Parva and Kilham, and thence to Driffield, starting from Lowthorpe at 12-7 noon.

Books and Maps.

The whole of the district for the day's investigation is comprised within Sheet 94 N.W., One-inch Ordnance map, which may be obtained geologically coloured. There appear to be no published records whatever for the Fauna and Flora of the district, which is therefore a promising field for investigation.

The District.

Lowthorpe, the starting point of the excursion, is a station on the North-Eastern Railway, four-and-a-half miles from Driffield. The very extensive woods on the right will doubtless amply repay careful investigation, they not having been explored; taking the high road for a quarter of a mile, crossing some fields Lowthorpe Mill is

reached, with a beautiful trout stream meandering along well stocked with the silvery fish. The village of Lowthorpe possesses a fine old ivy-covered church, with its monuments and an old cross. The walk being continued through the fields Bracey Bridge Mill is reached, and here the romantic scenery baffles description and will amply repay a long journey, the woods and bogs, with their hidden treasures of mosses, reeds, and flowers, forming a natural ampitheatre than which few places are more delightful.

The geological party will diverge here and proceed along the high road about half-a-mile to view a chalk quarry at Ruston Parva, in which are found sponges, *Belemnites*, and several other fossils of the chalk; the quarry will cover two acres and is nearly eighty feet deep—standing on the top a delightful view is unfolded to the gaze, on a clear day Hull, Beverley Minster, Foston, Kilham, Ruston Parva, Lowthorpe, and Harpham Churches and the ships in Bridlington Bay being observable. The party could either walk to Driffield (four miles) or, what some think preferable, return by another route to Lowthorpe Station (3-51 p.m. train), three miles.

Physical Geography and Geology.

The Rev. E. Maule Cole, M.A., F.G.S., writes :—The district to be visited forms the borderland between the wolds on the west, and the lowland on the east, which though not, strictly speaking, part of Holderness, is a continuation of it. A group of dales issuing from the watershed, known as the High Street, unite at Langtoft, and form a valley stretching S.E. to Kilham, which debouches on the plain near Lowthorpe. Here a beautifully clear stream, celebrated for its trout, is met with, which, rising at Beck Head a little to the east of Kilham, forms the most northern feeder of the river Hull. Occasionally, though very seldom in the course of many years, the water forming this beck has been known to burst forth at Henpit Hole, a mile-and-a-half north-west of Kilham. Then the 'gypseys' are said to be out. This requires some little explanation. The fact is that the chalk is very porous, and holds in the interstices of the rock a great deal of water. What is called 'the level of saturation' is continually rising and falling according to the rainfall. After prolonged heavy rains, which however seldom occurs on the Wolds, the chalk rock is so thoroughly saturated that it can hold no more, and then springs break out at weak points, and rivers, like the bournes in Surrey, are seen running in dry places. In addition to this, it must be remembered that the dip of the chalk is towards the east here, and that the plain of Holderness is covered with a thick mantle of impervious boulder clay, so that when as much water has been accumulated under it as the underlying chalk beds will hold, the surplus is bound to find its way out at the edges of the basin, much the same way as a cup will overflow the rim if you pour too much tea into it. Hence the springs, almost ready-made streams, which, in striking contrast to those on the N. and W., appear on the eastern margin of the Wolds.

Geologically, there is not much of interest in the present excursion. The Chalk beds belong to the Upper Chalk without flints, and

are fairly fossiliferous. Sponge remains, especially *Ventriculites*, and the pointed *Belemnitella mucronata* may be expected. It is uncertain whether any of the party will visit Little Kelk, as it lies to the east of the proposed route; but there are some interesting sand hills here, similar to many in Holderness, capped with boulder clay, which contain broken marine shells of Arctic type, and consequently are of inter-glacial age. In the valley bottom approaching Kilham there is another such sand mould, containing seams of drifted coal, as at Craike Hill, and marine shells, amongst which figures the ubiquitous *Tellina balthica.*

Botany.

Mr. M. B. Slater, F.L.S., gives the following information:—At this early season it is not much use going on to the hills for plants, as on the dry exposed chalk wolds vegetation will have made little progress. Botanists had better keep to the banks of the fine trout stream which can be followed for three or four miles from Lowthorpe Station, as in many places the banks are wooded and have boggy ground which yield some of the damp-loving mosses. The fine spring head where the crystal water comes bubbling out from the chalk is interesting. It supplies the water for the stream which flows through this portion of Holderness. In the stream and along its banks some water plants may be found, but at this early season very few will be in flower. Mr. Slater adds that he gathered some years ago *Cryphæa heteromalla* in the East Riding in the neighbourhood of Sledmere, and also in Danes Dyke, near Flamborough. As Lowthorpe lies in the district between these two localities it is possible that it may occur on the trees in this district. It is a rare moss for the north of England. The following is a list of plants which may be found in flower at this season:—*Caltha palustris*, *Alliaria officinalis*, *Cardamine pratense*, *Lychnis dioica*, *L. vespertina*, *L. flos-cuculi*, *Spiræa filipendula*, *Hippuris vulgaris*, *Petasites vulgaris*, *Menyanthes trifoliata*, *Myosotis palustris*, *Pedicularis palustris*, *Nepeta glechoma*, *Daphne laureola*, *Arum maculatum*, *Listera ovata*, *Orchis mascula*, *O. maculata*, *Scilla nutans.* The following Mosses and Hepatics have been seen at Lowthorpe. Mosses:—*Mnium punctatum*, *M. hornum*, *M. undulatum*, *Bryum nutans*, *Funaria hygrometrica*, *Ceratodon purpureus*, *Orthotricum lyellii*, *Atrichum undulatum*, *Amblystegium serpens* in variety, *Neckera complanata*, *Brachythecium rutabulum*, *Rhynchostegium confertum*, *Eurhynchium crassinervium*, *E. swartzii*, *Leucodon sciuroides*, *Climacium dendroides*, *Hypnum filicinum*, *H. cuspidatum.* Hepatics:—*Radula complanata*, *Lophocolea bidentata*, *L. heterophylla.*

Entomology.

No professed entomologist appears ever to have investigated the upper part of the dale, and nothing is known of its entomological fauna.

Conchology.

The Mollusca of this little dale do not appear to have received attention at the hands of conchologists, all that is known being that in the neighbourhood of Driffield Mr. L. B. Ross, F.C.S., meets with

various interesting species of mollusca, and that the woods along the course of the Lowthorpe stream and the chalky slopes towards its sources may be searched with fair expectations of success. The only shells actually met with in the area of the excursion itself are *Helix aspersa*, *H. rufescens*, *H. cantiana*, and *Anodonta cygnea*, so that there is ample scope for discoveries to be made.

Vertebrate Zoology.

Mr. F. Boyes contributes the following :—Neither Driffield nor Lowthorpe offer any special ornithological features, but both are eminently interesting so far as regards the number of semi-aquatic species found there (and especially in the winter months for the number of wild-fowl frequenting the becks). These swift running streams, flowing over their chalky beds, are famous for their Trout, which are of course strictly preserved. Here and there the margins of the streams spread out into swampy pastures where Snipe may be found breeding. Amongst a large number of species which may be expected to be noticed, the Reed Warbler is probably the most local. Its nest may be looked for suspended to the upright osiers (where left uncut), and all along the sedges near will be found the merry little Sedge Warbler and the 'quietly-disposed' Reed Bunting. On the streams themselves may be noticed the Dabchick (whose notes so much resemble those of the female Cuckoo), the Water Hen, Coot, and Wild Duck, all breeding in numbers. The Spotted Crake no doubt breeds also, as it does on the margins of the river nearer Beverley, but it requires the assistance of a good dog to find this bird. The Cockoo is numerous, as is generally the case near swampy ground where the Meadow Pipits abound ; the Kingfisher also breeds there. Amongst a host of summer songsters, a look-out should be kept for the Nightingale, which occurs in the district at uncertain intervals ; Wood Wrens also may be met with. Leaving the streams numbers of resident birds are to be found in the woods, such as Sparrow-hawk, Kestrel, Stock and Ring Doves, as well as the usual complement of small birds, the Great, Blue, Coal, Marsh, and Long-Tailed Tits, etc., etc. Swifts will be noted in numbers on the streams and, of course, House Martins, Sand Martins, and Swallows.

Fish.—The fish which occur in the streams are Trout, Pike, Perch, Roach, Dace, Chub, Bleak, Bream, Gudgeon, Minnow, Loach, Burbot, Eel, and Miller's Thumb.

The Mammals found in the district include Fox, Otter (rare), Badger (near), Stoat, Weasel, Long-tailed Field Mouse, Short-tailed ditto, Shrew, Water Shrew, Water Vole, Mole, Rat, Hare, and Rabbit.

Micro-Zoology and Micro-Botany.

No attention appears to have been paid to this branch of research, and it is to be hoped that microscopists will avail themselves of the opportunity for investigation.

Programme of Meetings.

4-45.—Meat Tea, 2/- each.
5-30.—Sectional Meetings.
6- 0.—General Meeting.
} All at Mr. Holtby's, "The Buck Inn," Driffield.

6-45.—Departure of train from Driffield Station.

Yorkshire Naturalists' Union.

President:
RT. REV. WM. WALSHAM HOW, D.D., LORD BISHOP OF WAKEFIELD.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

THE EIGHTY-FIFTH MEETING

WILL BE HELD AT

DEWSBURY,

FOR

BRETTON PARK,

ON

SATURDAY, 14th JUNE, 1890.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N.W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Dewsbury and Horbury Bridge, to Members and Associates of the Y.N.U. producing their signed card of Membership.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Railway Information.

Visitors from districts served by N.E.R. converging on Leeds should come on to Dewsbury by L. and N.W. from thence, and (*a*) cross the town (5 minutes) to L. & Y. Station (Market Place); book there to Horbury Bridge (fare, 3½d.; trains leave 10-0, 10-15, 12-43, 2-17), or (*b*) if equally convenient to arrive at Wakefield (Kirkgate Station), could leave there direct for Horbury Bridge (10-40, 11-58, 12-30, 1-50). Visitors from Hull, Goole, and Doncaster districts go by Wakefield (Kirkgate Station); from south-western portion of the county through Huddersfield may either change there and go by L. and Y. to Horbury Bridge, or go forward to Dewsbury and cross the town as at (*a*) route. Visitors arriving at Wakefield, G.N.R. (Westgate Station) can come forward to Dewsbury by same line and cross to L. and Y. Station (three minutes walk). There are nearly twenty stations within three miles of Dewsbury Market Place.

The District.

The district selected for investigation is Bretton Park, Coxley Valley, and Elmley Woodhouse.

The beautiful Woods and Park around and at Bretton Hall and the Lakes there are well worthy of a visit, and from the high ridge falling away from Woolley Edge to Midgley some very fine and extensive views will be obtained if the atmosphere is clear.

Routes.

The general rendezvous will be at Horbury Bridge Station, L. & Y. R., about 3½ miles S.E. of Dewsbury.

For the accommodation of everyone as far as possible, an early excursion will start from there at 11 a.m., and a later one at 1 p.m., both under efficient guides; one route being by Calder Bank, Hartley Bank Colliery, and Bullcliffe Wood to Bretton Park Village, returning by Stocks Moor and Midgley; the other by Coxley Valley, Stone Cliffe Wood, to Elmley Woodhouse and Bentley Springs, returning to Midgley.

Carriages will be provided for those *only* who send for a ticket to Mr. P. F. Lee, West Park Villas, Dewsbury, 1/1 each post free, at Midgley to drive through Thornhill, giving an opportunity of visiting the fine old church of the Thornhills and Saviles—leaving Midgley 4-0 p.m.

The Hon. Secs. are indebted to Mr. C. P. Hobkirk, F.L.S., and Mr. P. F. Lee for making the arrangements and drawing up the circular for the present meeting.

Books and Maps.

The district for investigation is somewhat unfortunately situated as regards maps, inasmuch as it comprises a circle including the four central corners of Sheets 87 N.W. and S.W., and 88 N.E. and S.E. of the One-inch Ordnance Survey, but the two former contain the chief area and may be obtained geologically coloured. There appear to be but few published records for the Fauna and Flora of the district, which is therefore a promising field for investigation.

Physical Geography and Geology.

Mr. J. W. Davis, F.G.S., contributes the following notes:—The district around Bretton Park is on the Middle Coal Measures which embrace all the coal seams and measures above the Silkstone Coal in the West Riding of Yorkshire. More rapid alternations of sandstone and shale replace the thick beds of sandstone which characterize the Lower Coal Measures and the Millstone Grit, and give a much greater variety and picturesqueness to the scenery and a richness to the soil which compensate for the wild magnificence and solitude of the grit-scarped moorlands. The Woolley Edge Rock ranges in a fine escarpment from New Miller Dam in a southerly direction along Woolley Edge, about two miles east of Bretton Park, and is continued southwards in the direction of Barnsley. The sandstone is a coarse thickly-bedded grit about 100 to 120 feet in thickness. Beneath the Woolley Edge Rock are a number of coal seams, the Winter, Beamshaw, Mapplewell, and Barnsley Coals are most important. At West Bretton the Horbury Rock comes to the surface with the Netherton Thick Coal beneath it; whilst further west, a bed of sandstone, which may be seen north and south of the lake, and in a quarry on the road side in the direction of High Hoyland, is superimposed on the Flockton Coals. At Elmley Moor and Clayton the Blocking Coal crops

out, which is generally supposed to be the northern equivalent of the Silkstone Coal. The whole of the district is very much dislocated by faults which add considerably to the beauty and variety of the scenery.

Botany.

Messrs. C. P. Hobkirk, F.L.S. and P. F. Lee give the following :— The carboniferous rocks are nowhere noted for an exuberant flora, but on the high grounds, along the streams, and in the deep woods to be traversed in this excursion, some not common plants should be gathered. The following have been noted (chiefly recorded by Messrs. Lee and Rushforth). About Horbury, *Barbarea stricta*, *Acorus calamus*, *Potentilla norvegica*, *Myrrhis odorata*, *Hottonia palustris*, &c. ; Hartley Bank, *Carex pallescens*, *Nitella opaca*, and the curious submerged habitat of *Polytrichum commune* and *Mnium hornum* noted at British Association Meeting at Manchester (1887) by Mr. Hobkirk ; Bullcliffe Wood, *Lepidium campestre*, *Papaver dubium*, *Brachypodium sylvaticum*, &c. ; Bretton, *Ranunculus auricomus*, *Epipactis latifolia*, *Juncus supinus*, and *J. uliginosus*, *Carex flava*, *Asplenium trichomanes*, and *Cephalozia Lammersiana.* In some old brick ponds here, probably several freshwater *Algæ* will be found ; Coxley Valley Woods, *Cardamine amara*, *C. flexuosa*, *Erodium moschatum*, *Agrimonia Eupatoria*, *Veronica montana*, *Plantago media*, *Habenaria viridis*, *Listera ovata*, *Scirpus sylvaticus*, *Sparganium simplex*, *Carex fragilis*, *C. longibracteata*, *C. flava*, *C. sylvatica*, *C. lævigata*, *Scolopendrium vulgare*, *Nephrodium spinulosum*, &c. ; Stocksmoor, *Hydrocotyle vulgaris*, *Erica tetralix*, *Veronica scutellata*, *Senecio erucifolius*, *Carex pilulifera*, &c. ; Elmley Woodhouse, *Draba verna*, *Adoxa*, *Viola odorata*, *Campanula latifolia*, *Taraxacum erythrospermum*, *Carex flava*, *C. panicea*, *C. vulgaris* var. (not named), &c.

Entomology.

Mr. W. E. Brady, Barnsley, supplies the following notes : *Thecla rubi* has been once taken a short distance from the park, and the following species are more or less common within or adjoining the proposed route, viz. : *Smerinthus ocellatus*, *Sesia bembeciformis*, the whole of the *Hepialidæ*, including fine varieties of *H. velleda*, *Procris statices*, *Arctia mendica*, *Ephyra punctaria*, *Asthena sylvata* (scarce), *Fidonia piniaria*, *Emmelesia decolorata*, *Melanthia albicillata*, *Melanippe hastata*, *Cidaria suffumata*, *Cilix spinula*, &c. Careful search should be made for *Melanippe unangulata*, which is reported to have been taken at Haw Park some years ago. The larvæ of *Chesias spartiata* may be looked for on Broom, and the Lime trees in the park may be expected to yield larvæ of *Xanthia citrago*. *Epunda viminalis* larvæ will probably be found freely in the rolled-up leaves of Sallow and are worth taking as the species in this district often yields a good per-centage of interesting melanochroic forms ; the leaves rolled by *E. viminalis* are frequently occupied by the carnivorous caterpillar of *Cosmia trapezina* ; care should be taken to exclude this pest from the collecting-box or the speedy destruction of many *viminalis* is inevitable.

Conchology.

Mr. W. Rushforth, of Horbury, states that he has taken *Planorbis nitidus* from pond near Crigglestone, *P. complanatus* and *P. spirorbis*, *Limnæa peregra*, common, and *L. stagnalis*, Bullcliffe Wood; *L. truncatula*, *Ancylus fluviatilis*, various species of *Limax*, *Vitrina pellucida*, *Zonites cellarius*, *Z. alliarius*, *Helix nemoralis*, *H. hortensis*, *H. arbustorum*, some with unusually thin shells in Bullcliffe Wood, *H. cantiana*, *H. rufescens*, *H. hispida*, *H. rotundata*, *Clausilia rugosa*, and *Cochlicopa lubrica* in Bullcliffe Wood.

Mr. Joseph Wilcock, of Wakefield, states that about fifty species of land and freshwater shells are known to him as occurring on the different routes selected for the day's ramble, some of which are of peculiar interest as not hitherto known to British Conchologists, and as having been determined by the eminent French conchologist, M. J. R. Bourguignat. *Unio tumidus* and varieties *picta* Beck, *rohrmannii* Kob., *wilcockii* Bourg., *Unio pictorum*, *Anodonta cygnæa* L., and vars. *complanata*, *subarealis* Fagot, *maculata* sub-var. *minor* Bourg., *codopsis* Servain, *calara* Servain, and *palustris* d'Orb., *Dreissena polymorpha* and vars. *dilatata* Colb., and *elongata* Colb., *Arion subfuscus* and var. *distincta*, *Limax arborum*, *Vertigo antivertigo*, etc.

Vertebrate Zoology.

Although a tract of country like the present, which was within the range of the observation of such accomplished ornithologists as the late Wm. Talbot and the late Thomas Lister, can hardly be said to have been uninvestigated, the compilers of this circular have been unable to obtain information on this head. It may, however, be noted that the district being well-wooded should be rich in birds of sylvan habit, and that ornithologists may well expect to note numerous species during the day's walk.

Micro-Zoology and Micro-Botany.

Although some little attention has been paid to this branch of research, it is to be hoped that microscopists will avail themselves of the opportunity for further investigation.

Programme of Meetings.

Conveyance leaves Midgley at 4 p.m. and reaches Dewsbury in time for tea (see under Routes).

Train leaves Horbury Bridge for Dewsbury 4-27 p.m. in time for tea.

5- 0.—Meat Tea, 2/- each.
6- 0.—Sectional Meetings.
6-30.—General Meeting.
} All at Royal Hotel, Dewsbury.

Trains from Dewsbury—

To Leeds, 7-14, 7-20, 7-47, 8-27, &c.
„ Wakefield, G.N.R., 8-27, 9-7, 9-50, 11-34.
„ „ L. & Y. 7-13, 7-30, 8-25, 9-45, &c.
„ Huddersfield, frequent up to 11-40.

Yorkshire Naturalists' Union.

President:
RT. REV. WM. WALSHAM HOW, D.D., LORD BISHOP OF WAKEFIELD.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

THE EIGHTY-SIXTH MEETING

WILL BE HELD AT

MIDDLESBROUGH,

FOR

KILDALE,

ROSEBERRY TOPPING,

The Cleveland Dyke, Easby and Kildale Woods, &c.,

On SATURDAY, 12th JULY, 1890

(Instead of Tuesday, 8th July, as originally arranged).

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Middlesbrough or Kildale, to Members and Associates of the Y. N. U. producing their signed card of Membership.

Holders of Middlesbrough tickets will be permitted to break the outward journey at Kildale or Battersby Junction, and holders of Kildale tickets to break the homeward journey at Middlesbrough.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

The District.

The district selected for investigation is the Valley of the Leven from Kildale to Battersby and Ayton, the Moors above, and the Whinstone Dyke at the foot of Roseberry Topping.

Routes.

I.—Botanists, &c., leave Kildale Station at 11-48, walk through the woods along the course of the Leven to Battersby Junction, about two miles. Leaders, Mr. R. Lofthouse and Mr. Baker Hudson.

II.—Geologists, with Route I as far as Bleach Mill, strike up the wood to Easby Moor, thence to Capt. Cook's Monument and to Ayton Whinstone Quarries, returning from Ayton Station, three or four miles. Leaders, Dr. W. Y. Veitch and Rev. J. T. Hawell, M.A.

III.—Entomologists, &c., with Route II, will diverge for the examination of Easby Wood, and return from Ayton Station, three miles. Leader, Mr. T. A. Lofthouse.

Permission is granted by Lady De L'Isle and Dudley, Capt. R. Bell Turton, and Mr. James Emerson for members to visit their estates, and by Mr. W. Winn in respect of his whinstone quarries.

Books and Maps.

The district for investigation is entirely situated in the S.W. corner of Sheet 34 (formerly 104 S.W.), One-Inch Ordnance Map (which may be had coloured geologically). Reference may also be made to the Geol. Survey Memoir illustrating the sheet, to Tate and Blake's Yorkshire Lias, to the Handbook of Middlesbrough and District (1881), Rev. Jno. Hawell's Parish Register of Ingleby Greenhow (introductory chapter), British Association Reports (Boulders), a paper by J. W. Watson on Airy Holme Wood (Morris' Naturalist, 1854, p. 228), Dixon and Watson's Manual of British Shells (local records), etc.

Physical Geography and Geology.

Dr. W. Y. Veitch, of Middlesbrough, contributes the following notes :—Roseberry Topping is an outlier, 1,054 feet high, having been severed from its connection with the neighbouring moorland by glacial action, and is a good example illustrating the cause of the rugged contour of the Cleveland hills, which are capped with Lower Oolite sandstone ; water percolating the sandstone softens and washes away the alum shale (Lias) immediately below, the sandstone falling and mixing with the displaced shale leaves behind a cliff and makes a sloping terrace to the next hard rock (*A. margaritatus* zone) where the same weathering process is repeated, forming another steep descent and gradual declivity to the bottom of the hill. The descent is through the following section :—

Lower Oolite 50 feet ; Dogger is absent ; Alum Shale (*A. communis* zone) 107 ; Jet rock (*A. serpentinus* zone) 25 ; Grey shale (*A. annulatus* zone) 30 ; *A. spinatus* zone (main seam of ironstone 5 feet) 20 ; *A. margaritatus* zone 120 ; *A. capricornus* zone 140 ; *A. jamesoni* zone 50 feet.

The Cleveland Whin Dyke cuts through the south-west side of the hill, and is seen to the north-west as Langbarugh Ridge, which owes its prominence to the dyke. This intrusive rock is 80 feet thick at the base of Roseberry and only 20 feet thick at its apex 350 feet above. At Kildale there are peat beds from which horns of *Cervus elaphus* (Red-deer) and *C. tarandus* (Reindeer) have been taken. As to scenery, Kildale has been described as a gem. In going down this lovely vale from the railway station, disused ironstone mines are passed and the *A. spinatus* and *A. margaritatus* beds are exposed until the pretty waterfall, known as Old Meggison is reached ; the water falls over the Lower Sandstone of the Marlstone series of Phillips' (*A. margaritatus* zone). The *A. capricornus* and *A. jamesoni* beds are come upon as the course of the Leven is followed.

The Rev. John Hawell, M.A., vicar of Ingleby-Greenhow, recommends that geologists should, in addition to their examination of the Augite-andesite Dyke, inspect the white sand deposit near Kildale Station, and give some attention to the boulders and other legacies of the glacial age. They should also, if time permit, hammer over the heaps of Middle Liassic Ironstone rubbish near Kildale Station and at the base of Roseberry Topping. From these heaps have been obtained such fossils as *Belemnites breviformis*, *Ostrea submargaritacea*, *Pecten æquivalvis*, *Lima hermanni*, *Limea juliana*, *Plicatula calva*, *Monobis cygnipes*, *M. inæquivalvis*, *Astarte striato-sulcata*, *Protocardium truncatum*, *Pholadomya ambigua*, *Gressyla seebachii*, *Rhynchonella tetrahedra*, *Terebratula punctata*, *Chordophyllites cicatricosus*, &c.

Botany.

Mr. Thomas F. Ward, Middlesbrough, considers that the district will be found to be an interesting one to the botanist, for although he

is not likely to meet with any great rarity he will be rewarded by a satisfactory day's work. The following plants were all observed in the woods or higher ground about Kildale at this time last year:—*Ranunculus Flammula*, *Cardamine amara*, *Viola tricolor*, *Drosera rotundifolia*, *Geum rivale*, *Asperula odorata*, *Campanula latifolia*, *Pedicularis palustris*, *Lysimachia Nummularia*, *Habenaria viridis*, *Listera ovata*, and *L. cordata.*

The Rev. John Hawell, M.A., vicar of Ingleby Greenhow, has observed the following plants on the line of route to be taken by the botanical party:--*Polygala vulgaris*, *Lychnis diurna*, *Lathyrus pratensis*, *Spiræa ulmaria*, *Geum urbanum*, *G. rivale*, *Potentilla tormentilla*, *P. reptans*, *Agrimonia Eupatoria*, *Epilobium hirsutum*, *Sanicula europæa*, *Asperula odorata*, *Arctium Lappa*, *Solidago Virgaurea*, *Campanula latifolia*, *Scrophularia nodosa*, *Mimulus luteus*, *Veronica Beccabunga*, *Euphrasia officinalis*, *Pedicularis palustris*, *P. sylvatica*, *Scutellaria galericulata*, *Teucrium scorodonia*, *Lysimachia nemorum*, *Listera ovata*, *Allium ursinum*, and *Briza media.*

Entomology.

Mr. T. A. Lofthouse considers that the district ought to be a very favourable one for insects, being well wooded, principally oak. *Pieris napi*, *Anthocharis cardamines*, *Satyrus hyperanthus*, *S. megæra*, *Cœnonympha pamphilus*, *Argynnis paphia*, *A. adippe*, *Vanessa cardui*, *V. atalanta*, *V. io*, *Polyommatus phlœas*, *Sphinx ligustri*, *Smerinthus populi*, *Acherontia atropos*, *Macroglossa stellatarum*, *Saturnia carpini*, *Eriogaster lanestris*, *Cossus ligniperda*, *Triphæna fimbria*, *Miselia oxyacanthæ*, *Plusia interrogationis*, *P. chrysitis*, *Mania maura*, *Bombyx quercus*, *Odontopera bidentata*, *Larentia cæsiata*, *Camptogramma bilineata*, *Fidonia atomaria*, *Cidaria immanata*, *C. pyraliata*, *C. fulvata*, *Eubolia palumbaria*, *E. mensuraria*, *Tanagra chærophyllata*, and *Cicindela campestris* are among the species reported as having been taken.

Conchology.

Mr. Baker Hudson, M.C.S., Middlesbrough, writes that the Kildale woods, occupying the southern skirts of Easby Moor and resting on the outcrop of Liassic strata, he has found to be very prolific in molluscan life. Among the common forms observed he mentions *Helix arbustorum*, *H. nemoralis*, *H. hispida*, *H. concinna*, *H. sericea*, *H. rotundata*, and *H. aculeata*. *H. fusca* is also fine and abundant, whilst *H. pygmæa* occurs sparingly near the Bleach Mill. *Zonites cellarius*, *Z. nitidulus*, *Z. alliarius*, and *Z. crystallinus* are abundant and *Z. purus* and its var. *margaritacea*, together with *Z. fulvus*, occur in suitable situations. *Z. nitidus* he has once found near the low end of the wood. *Clausilia laminata* and *C. rugosa* are common and fine and a large variety of the latter should be looked for which requires identification. *Bulimus obscurus* also occurs and *Balea* may be expected, as it has been taken by the Rev. J. Hawell near Ingleby. *Pupa umbilicata* is common and *P. marginata* occurs sparingly near the moor edge. *P. ringens* should be carefully looked for as in many parts the wood is similar to Airey Holme in the condition of its soil (a rich leaf mould). He has taken *Vertigo edentula* and *V. substriata*, of the latter only one specimen in moss and dead leaves. *Zua* and *Azeca*

are both present. *H. hortensis* occurs on roadsides near Kildale and *H. rufescens* is a classical record requiring confirmation. *Ancylus fluviatilis* occurs in the Leven and some years ago he took three specimens of a large *Pisidium* which might prove on further investigation to be *P. fontinale*, in a small runnel crossing the road close to Battersby village. *Limnæa peregra*, *L. truncatula*, and *Sphærium corneum* Mr. Hudson has also taken in ponds near Kildale and Battersby.

Rev. John Hawell adds that of the shells noted by Mr. Hudson he has personally obtained the majority in the Kildale wood, and all, except *S. corneum*, *H. pygmæa*, *Bulimus obscurus*, *Succinea putris*, *Pupa marginata* and *V. substriata*, he has obtained either there or in his own parish of Ingleby, in which Battersby Junction is situated, and though he has not himself met with *S. putris*, he was a member of an excursion party when Mr. T. A. Lofthouse obtained a specimen in the wood. *Balea* has occurred to him abundantly in his parish, as also four specimens of its rare var. *viridula*. *H. caperata*, *Vitrina*, and *H. cantiana* occur by the side of the railway between Battersby Junction and Kildale Wood, the last mentioned being probably a railway importation. *Pisidium fontinale* is plentiful in Ingleby Park Wood. *Planorbis nautileus* occurs in different parts of his parish. *Carychium* he has taken in Easby Wood, and very abundantly in Ingleby Churchyard. *Limnæa glabra*, *Planorbis spirorbis* and *Physa hypnorum* he recently found together in a stagnant ditch about three miles from Battersby Junction, so that search may be made for them as well as for *H. lamellata*, which formerly occurred in the Airy Holme Wood.

Vertebrate Zoology.

Mr. R. Lofthouse, Middlesbrough, remarks that all the commoner birds are found at Kildale and in the neighbourhood in abundance. Probably the most interesting bird to be met with is the Pied Fly-catcher; this rather locally distributed species breeds in the woods here. Of migrants the Willow Wren, Wood Wren, Chiff Chaff, and Sedge Warbler are met with, and in the woods the Wood-Pigeon, Pheasant, Sparrow Hawk, and Kestrel. By the margin of the Leven, may be noticed the Pied and Yellow Wagtail, the Kingfisher, Dipper, Sand Martin, House Martin, Swallow, and Swift. In suitable localities the Mountain Linnet and Tree Sparrow are found, and on the moors are Grouse, Curlew, Golden Plover, Ring Ouzel, and Wheatear.

Mammals, etc.—In the Leven are abundance of Trout of small size, and lower down the stream Roach, Dace, Chub, Gudgeon, Eel, and Flounder are found. The Viper, Ringed Snake, and Slow Worm are not uncommon. All the common Mammals, including the Squirrel, Water Vole, and Water Shrew are met with.

Micro-Zoology and Micro-Botany.

Although some little attention has been paid to this branch of research, it is to be hoped that microscopists will avail themselves of the opportunity for further investigation.

Programme of Meetings.

5-40.—Meat Tea, 2/- each.
6-30.—Sectional Meetings.
6-45.—General Meeting.

All at the Dining Room, Middlesbro' Railway Station.

7-28.—Departure of train for all parts.

Yorkshire Naturalists' Union.

President:
RT. REV. WM. WALSHAM HOW, D.D., LORD BISHOP OF WAKEFIELD.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

THE EIGHTY-SEVENTH MEETING

WILL BE HELD AT

MUKER, MONDAY, Aug. 4, 1890,

IN CONNECTION WITH A

THREE DAYS' EXCURSION,

From Saturday, 2nd Aug., to Monday, 4th Aug.,

FOR THE INVESTIGATION OF

UPPER SWALEDALE.

Railway Arrangements.

Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N. E. Railways, which have booking arrangements for Askrigg, to Members and Associates of the Y.N.U. producing their signed card of Membership.

Tickets taken on Friday or Saturday, August 1st or 2nd, will be available to return on Monday or Tuesday, August 4th or 5th.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

Hotel Accommodation.

This is very limited. Tariff per day for Tea, Bed, Breakfast, and attendance: At Keld, 'The Cat Hole,' 5/-; at Thwaite, 'Joiners' Arms.' 5/6; at Muker, 'Farmers' Arms,' 4/-; Queen's Head, 4/-; 'King's Head,' 4/-; at Gunnerside, 'King's Head,' 4/6; 'Miners' Arms,' 4/-. The Hon. Secs. have arranged to secure accommodation for members applying to Mr. Roebuck not later than 21st July, beyond which, they wish it to be distinctly understood, they undertake no further responsibility. Members wishing to be at the same place are requested to mention the fact, for if the attendance be large it will be necessary for members to share the accommodation.

Routes.

The district for investigation is the Swale basin from Isles Bridge upwards, but more particularly near Keld, Kisdon, and Muker.

The excursion will be under the direction and superintendence of Mr. J. G. Goodchild, F.G.S., M.B.O.U., by whom the district was geologically surveyed; while the Rev. R. V. Taylor, B.A., vicar of Melbecks, Rev. W. Crombie of Keld, Mr. Fawcett of Thwaite, Mr. W. Horne, F.G.S., Mr. W. Denison Roebuck, F.L.S., Mr. R. Barnes, etc., will place their local knowledge at the service of members.

Permission is granted by Capt. Lyell and Mr. Jas. Alderson for their estates to be visited, but in view of the near approach of grouse shooting, members are requested to confine their researches to the valley.

Saturday, Aug. 2nd.—Members all book to Askrigg. Trains arrive from Northallerton and the east at 12-8 p.m., and from Hawes Junction and the west at 1-27 p.m. The party leaves Askrigg on foot

at 1-30, under the leadership of Mr. J. G. Goodchild, to cross the moor into Swaledale by way of Oxnop Pass, Muker, Thwaite, and Angram, to Keld. The leader will point out the chief geological features en route, and members will be conducted to their respective destinations. Distances from Askrigg:—To Muker, 5 miles; to Gunnerside, 6 miles; to Thwaite, 6 miles; to Keld, 8 miles.

Members unable to reach Askrigg before 5-23 and 6-42 p.m., are requested to advise the Secretaries in order that arrangements may be made for guides to conduct them over the moor.

Conveyance of Luggage.—Members requiring more luggage than they can conveniently carry personally are requested to advise the Secretaries, in order that arrangements may be made for its transportation. The cost to be defrayed by the members requiring it.

Monday, August 4th.—The geologists will devote the forenoon to the examination of Kisdon, under Mr. J. G. Goodchild, while the naturalists are recommended to investigate the scars, hill-slopes and sheltered woods below Keld and about Kisdon Force.

At twelve noon the General Meeting will be held at Muker.

At the conclusion of the General Meeting the party will start for Hawes, viâ the Buttertubs Pass, under the leadership of Mr. J. G. Goodchild. Ropes will be provided, for such members as may wish to explore the Buttertubs more thoroughly.

* It is hoped that Members who can afford the time will devote another day or two to the investigation of the district.

Books and Maps.

The whole district is included in Sheet 40 (formerly 97 N.W.) One-Inch Ordnance Map, which (although surveyed) has not yet been published geologically coloured. The Botany is treated of in Baker's North Yorkshire, 1863, and second edition, 1887 (see Trans. Y.N.U., part 13, pp. 145—148); the Mosses by Richd. Barnes (Nat., July 1890, pp. 211—222); the Birds by J. E. Tinkler (Zool., April and May 1884, pp. 131—139 and 196); the Mollusca by W. Denison Roebuck (Nat., Aug. 1890); the Geology by John Phillips, in his classical works on the 'Mountain Limestone,' and on the 'Rivers, Mountains, and Sea-coast of Yorkshire.' Routh's 'Rambles in Swaledale' (1880) has a chapter on Geology; Rev. R. V. Taylor, B.A., has printed notes on the rarer plants ('Darlington and Stockton Times'); and Miss M. Plues includes many Swaledale notes in her various botanical works. A book on 'Birds and Birds' Nests,' just published by Cassell & Co., is by R. Kearton, formerly an inhabitant of Muker.

Physical Geography and Geology.

Mr. J. G. Goodchild, F.G.S., states that Upper Swaledale is situated in the northern portion of the great upland tract lying on the eastern side of the angle formed by the conjoined Craven Fault, and the Barbon–Kirkby-Stephen branch of the Pennine Fault. The general summit level of the *massif* is now more than 2300 feet above the sea, from which elevation the surface declines in one direction towards the valley of the Tees, and in another direction towards the Vale of York. The western boundary of Swaledale coincides with the central watershed of northern England, and from this, towards the west, the fell side descends rapidly towards the fertile lowlands of north-east Westmorland.

Swaledale consists exclusively of carboniferous rocks, which are gently inclined on the whole, towards the north-east, although faults and local disturbances of the strata combine to render this larger feature somewhat obscure. The strata are mostly the Yoredale rocks, which form the greater part of the more striking natural features. These rocks consist of alternations of beds of marine limestone, sandstone, shale, coal, and, near their higher portion, of peculiar siliceous beds, now proved to be of organic origin. The general thickness of the Yoredale rocks is about

1800 feet. Below the Yoredale rock comes the mountain limestone, which, well seen under Ingleborough, is here only represented at the surface by its uppermost beds. The Yoredale rocks are surmounted by the remnants of the millstone grit, which are left as cappings on the summits of the higher Fells. The Swale and its tributary streams have sunk deep vallies into the old massif—in some places nearly two thousand feet below the general level of the summit-plateau. The varied hardness or durability of the component strata has given rise to a fine series of waterfalls, scars, and picturesque fell-sides, whose beauty is finely set off by the wild nature of the moory uplands adjoining.

The first day's route will commence upon the upper beds of the Mountain Limestone at Askrigg, will lie thence over the whole thickness of the Yoredale rocks, and will traverse the base of the Millstone Grit at the watershed between Wensleydale and Swaledale. From this point the Yoredales will be again traversed in reverse order; and the route from Gunnerside up the dale will lie chiefly along a narrow strip of Mountain Limestone, corresponding to the beds seen on starting.

The fine scenery around Keld, Kisdon, &c., is chiefly formed by the Yoredale rocks; but the numerous faults and local variations of dip bring in fragments of Millstone Grit at intervals. The watershed at the head of the dale consists chiefly of Millstone Grit, which forms fine mural precipices on the Westmorland side.

Monday's route will lie again across the outcrop of the Yoredale rocks, the highest thick limestone of the series, the main or twelve fathom limestone, forming the bed through which surface waters have eaten out the remarkable swallow-holes known as the Buttertubs. On the Wensleydale side the route will pass near the section taken by Prof. John Phillips as the type-section of the Yoredale rocks. Hardra Fors lies on the way, near Hawes.

Botany.

Members are recommended to refer to Baker's North Yorkshire for a full and detailed account of the district to be investigated (see Part 13 of Y.N.U. Trans., pp. 145—148).

Mr. Richard Barnes, Saltburn, writing from a bryological standpoint, considers that the district extending from the junction of the Whitsundale Beck with the Swale down to Muker and Gunnerside is the richest and most interesting portion of Upper Swaledale. Between these points, and mostly near Keld, are situated some of the finest localities, viz.:—Kisdon Scars, and those opposite the smelting mill above Keld, locally known as Cotterby Scars, and the waterfalls of Cat Rake and Kisdon Force, all of which are well worth exploring, and yield some of the rarest mosses. On and near the scars opposite the smelting mill the following rarer species occur:—*Blindia acuta*, *Trichostomum crispulum*, *Trichostomum nitidum*, *Barbula intermedia*, *Amphoridium Mougeotii*, *Bartramia ithyphylla*, *Plagiothecium pulchellum*, *Hypnum stramineum*. At Cat Rake, Kisdon Force, Kisdon Scars, East Stonesdale, and Gunnerside may be found *Andreæa alpina*, *Gymnostomum commutatum*, *Dicranella Schreberi* and var. *elata*, *Seligeria Doniana*, *S. pusilla*, *S. acutifolia* var. *longiseta*, *S. tristicha*, *Didymodon cylindricus*, *Didymodon sinuosus*, *Barbula recurvifolia*, *Zygodon Stirtoni*, *Bryum alpinum* var. *meridionale*, *Bryum concinnatum*, *Fissidens decipiens*, *Neckera pumila*, *Anomodon longifolius*, *Amblystegium Sprucei*. The district will, doubtless, on diligent search yield some of the rarer Hepaticæ. *Lejeunea Rossettiana* Mass. has been met with in the lower portion of the dale at Hudswell and Richmond.

Entomology.

No attention has been paid to insects as yet. *Carabus nitens* is common at 1620 feet on Birkdale Tarn moss (W. Eagle Clarke), and *Selenia lunaria* has been taken near Muker by Mr. S. L. Mosley.

Conchology.

Mr. W. Denison Roebuck, F.L.S., Leeds, observes that the list of Upper Swaledale Mollusca (see Naturalist for August, 1890), includes so far thirty-five species, only two of which—*Limnæa truncatula* and *Ancylus fluviatilis*—are aquatic forms, the swift and turbulent character of the Swale and its tributaries being unfavourable to a longer list. It is strange, however, that *L. peregra* has not yet occurred. The seven slugs are the ordinary forms, while the montane and calcareous character of the district is shown by the abundance of *Clausilia dubia*, *Balea*, *H. arbustorum* and *H. rupestris*. Other species present include *Helix sericea*, which is well distributed and very common, *Azeca*, *Bulimus obscurus*, *Vertigo pygmæa*, *Carychium*, *Helix pulchella*, *H. rufescens*, and eight species of *Zonites*. Of the species not recorded search should be made for *Limax maximus*, both *Succineæ*, *Helix concinna*, *H. pygmæa*, *Vertigo edentula*, *H. fusca*, *H. aculeata*, etc. The road-sides from Isles Bridge upwards to Keld, and the limestone scars at Gunnerside and elsewhere are prolific hunting grounds, while the luxuriant and well-sheltered woods of the romantic gorge in which the Swale dashes over the beautiful Force of Kisdon, and the scars which border the river north of Keld, have never been thoroughly investigated, and the woods might even be found to produce not only the above, but such species as *Helix lamellata*, *Pupa ringens* and *Clausilia laminata*, none of which are on record.

Vertebrate Zoology.

The mammals known include the Red Field Vole (E. R. Waite), Water Shrew (S. L. Mosley), Water Vole, Squirrel, &c. The Reptiles include the Lizard and Slowworm (Viper absent), and the Fishes are Loach, Minnow, Bullhead, Eels, and Trout. The Oxnop Beck Trout have been described by Day as distinct, under the name of *Salmo fario swaledalensis*.

Mr. J. G. Goodchild writes that the birds are those common to nearly all the upland areas of the North of England. The Buzzard a few years since, and the Peregrine, the Raven, the Merlin, and occasionally the Short-eared Owl bred, not uncommonly, among the moors. The Curlew, Dunlin, Common Snipe, and Golden Plover are common in the breeding season. Amongst the smaller birds the Grey Wagtail, Dipper, and Ring Ousel are common. Mr. S. L. Mosley has found the Dunlin's nest, and noted Ravens, a species which has bred in the dale within recent years.

Micro-Zoology and Micro-Botany.

Mr. W. West, F.L.S., has recorded (Nat., Aug. 1889, p. 246) various species of Algæ found on Birkdale Tarn moss, at 1620 feet, including several uncommon ones, and would be glad for members to send him tubes containing water from permanent pools on the moors.

Programme of Meetings.

Monday, 12 noon, General Meeting, at Muker.
do. 4-30, Meat Tea, 2/- each, White Hart Hotel, Hawes.

Yorkshire Naturalists' Union.

President:

RT. REV. WM. WALSHAM HOW, D.D., LORD BISHOP OF WAKEFIELD.

Hon. Secretaries:

WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.

REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.

Hon. Assistant Secretary:

EDGAR R. WAITE, F.L.S, Philosophical Hall, Leeds.

THE EIGHTY-EIGHTH MEETING

WILL BE HELD AT

MALHAM,

FOR THE INVESTIGATION OF THE

Malham plateau, Tarn, & Cove,

GORDALE SCAR, &c.,

On THURSDAY, SEPT. 11th, 1890.

The present excursion is one of those arranged in connection with the Leeds Meeting of the British Association, and is necessarily limited to Members and Associates of the Association. It is hoped, however, that members of the Yorkshire Naturalists' Union who belong to the Association will co-operate in making this excursion successful. In view of the special circumstances of the case, members are particularly requested to AT ONCE inform Mr. KNUBLEY or Mr. ROEBUCK (at the Reception Room, Leeds) of their wish to join the excursion.

Railway Arrangements.

A special train will leave Leeds at 8-25 a.m., and will be available only for holders of tickets, price, 11/- first class, 9/- 3rd class (including Luncheon, Tea, Conveyance, and Railway Fares), to be obtained at the Reception Room, British Association, Leeds.

Routes.

Permission is granted by Mr. Walter Morrison, M.P., for members to visit his estates, and for his boats to be used by the party visiting Malham Tarn.

On arriving at Bell Busk at 9-15, waggonettes will convey the party to Malham, a stoppage being made at Kirkby Malham to permit of the inspection of the interesting signatures by Oliver Cromwell in the Church Register, by kind invitation of Rev. T. C. Henley, Vicar.

10-30 a.m., Luncheon will be served at 10-30 a.m., at the Buck Hotel, Malham.

11-30 a.m., the parties will start, under the leadership of officers and prominent members of the Union.

The geologists will be under the charge of Mr. R. H. Tiddeman, M.A., F.G.S., Mr. J. W. Davis, F.S.A., F.G.S., &c.

Mr. C. P. Hobkirk, F.L.S., will lead the botanists and zoologists purposing to investigate the immediate neighbourhood of Malham, including Malham Cove, Gordale Scar, Janet's Force, &c. Distance to walk, about three miles.

Good pedestrians desirous of investigating the natural history of Malham Tarn and the neighbouring portions of the moorland will accompany Messrs. W. Denison Roebuck, F.L.S., and Edgar R. Waite, F.L.S. Distance to walk about five miles. The boats on the Tarn will be at the disposal of this party, for the purpose of collecting the mollusca, &c.

Messrs. J. Backhouse, junr., F.Z.S., C. Brownridge, F.G.S., Thomas Bunker, W. Norwood Cheesman, J. Cordeaux, M.B.O.U., John Emmet, F.L.S., Rev. E. P. Knubley, M.A., Rev. H. Annesley Powys, M.A., W. Denison Roebuck, F.L.S., J. H. Rowntree, Edgar R. Waite, F.L.S., and other officers and members of the Union will also take part in the excursion.

All parties will return to the Buck Hotel for Tea at 4 p.m.

Books and Maps.

The district is all included in Sheet 60 (or 92 N.W. of old series), One-Inch Ordnance Map, which is not published geologically coloured. For geological information see Phillips' Mountain Limestone, and his Rivers, Mountains and Sea Coast, Davis & Lees' West Yorkshire, the Handbook for the Leeds meeting of the British Association, &c. For Botany, see the Flora of West Yorkshire, and L. C. Miall's valuable papers in the Naturalist for 1864-67; also Windsor's Flora Cravoniensis, and Miall's Geology and Natural History of Craven (reprinted from Whitaker's Craven). For Conchology, see Roebuck's paper in current number of Naturalist. For Vertebrata, see Clarke & Roebuck's Handbook of Yorkshire Vertebrata, and H. B. Booth on Malham Ornithology in current number of Naturalist.

Physical Geography and Geology.

Mr. J. W. Davis, F.S.A., F.G.S., writes: The great Craven Fault exposed at Malham and Gordale runs in a direction nearly E. and W. from Ingleton to Pateley Bridge. From Ingleton the line of fault makes a sweep round Austwick and Feizor and thence along the magnificent escarpment of Giggleswick to Settle; thence proceeding eastwards the grand series of scars at Attermire and Langcliffe, perhaps the finest along the whole line of dislocation, extend towards Malham. The scars to the north of the fault are composed of Mountain Limestone; whilst southwards the Yoredale Rocks and Millstone Grits form a series of rounded hills, which extend far southwards. Where the interior of the rounded hills is exposed in natural or artificial sections, the limestones and shales are found to be contorted and bent on themselves, sometimes at very sharp angles. That so hard and brittle a substance should be thus folded, without being broken, indicates a long-continued lateral pressure, and this being clearly due to the powerful action producing the fault, it follows that the latter was the result of a force prolonged over an indefinite period. From Langcliffe Scars the fault extends between the dry limestone hills of Kirkby Fells on the north, and the wet boggy surface of the Millstone Grit of Ryeloaf Hill, and thence to the valley of the Aire; forming the highly interesting escarpments of Malham Cove and Gordale Scar, the latter unequalled for wild grandeur in the country. The limestone has been cut back by a stream descending from the moorlands above, forming precipitous cliffs on each side, 300 feet in height. Below the limestone at the foot of the gorge, Silurian Grits may be seen; whilst southwards the grits of the Carboniferous age flank the cliffs. From Gordale the fault proceeds eastwards through Skirethorns. A northern branch of the fault extends across Malham Moor, near the Tarn; its exact line is much obscured by drifts but there is a throw of several hundred feet. From Malham Tarn this branch of the fault proceeds to Kilnsey, where striking evidence of the upheaval may be seen in Kilnsey Crag. At the foot of Gigglewick Scar is the Ebbing and Flowing Well and in Attermire Scar the Victoria Cave, the ancient habitat of the hyena and bear, and more recently of man, is situated. The River Aire has its source in several small streams which rise in the moorlands at the foot of Fountains Fell and Hard Flask. The streams converge in Malham Tarn, and the water empties from it in a river which runs about half a mile southwards, and then sinks through a large opening in the limestone pavement, filled to the surface with large rounded blocks of stone. Nothing more is seen of the water until it emerges at the foot of Malham Cove. It is recorded that the stream at one time tumbled over the face of the Cove in a fine cataract. From the Cove the Aire passes through the village of Malham and half a mile below is joined by the stream from Gordale.

Botany.

Messrs. W. West, F.L.S., H. T. Soppitt, and C. P. Hobkirk, F.L.S., state: Malham is botanically one of the richest places in the British Isles, and abounds in rare plants, some of which will be past flowering but may be gathered in fruit. The following list includes some of the rarities that can be obtained. Hardly any Fungi are recorded, as the district has not been worked for Agarics, although a large number of the epiphyllous species have been collected, many of which are rare. Owing to the comparative absence of woodland &c. the district is deficient in fungi, especially the larger species (Hymenomycetes), yet there are many pasture-loving species as well as some few choicé Discomycetes. The Uredines are fairly well represented, a list of the most interesting being appended. There is also plenty of room for work amongst the Lichens.

Flowering Plants, &c.—*Thalictrum montanum*, *Actæa spicata*, *Cochlearia alpina*, *Draba muralis*, *D. incana*, *Thlaspi occitanum*, *Viola lutea*, *Alsine verna*, *Hypericum montanum*, *Geranium sanguineum*, *G. sylvaticum*, *Hippocrepis comosa*, *Rosa tomentosa*, *R. pimpinellifolia*, *Poterium Sanguisorba*, *Alchemilla montana*, *Potentilla alpestris*, *Rubus saxatilis*, *Geum intermedium*, *Pyrus rupicola*, *Ribes petræum*, *Saxifraga hypnoides*, *Sedum villosum*, *S. Telephium*, *Galium sylvestre*, *Scabiosa Columbaria*, *Carduus heterophyllus*, *C. nutans*, *Taraxacum erythrospermum*, *T. palustre*, *Antennaria dioica*, *Hieracium Gibsoni*, *Vaccinium Oxycoccos*, *Polemonium cæruleum*, *Pinguicula vulgaris*, *Calamintha Acinos*, and a mountain form of *Myosotis sylvatica*, *Primula farinosa*, *Salix phylicifolia*, *Taxus baccata*, *Potamogeton densus*, *P. lucens*, *P. perfoliatus*, *Orchis incarnata*, *Gymnadenia albida*, *Convallaria majalis*, *Polygonatum officinale*, *Blysmus compressus*, *Scirpus pauciflorus*, *Eriophorum latifolium*, *Carex capillaris*, *C. vesicaria*, *C. disticha*, *C. paludosa*, *Sesleria cærulea*, *Koeleria cristata*, *Asplenium viride*, *Polypodium calcareum*, and *Selaginella selaginoides*.

Mosses.—*Sphagnum deflexum*, *Gymnostomum curvirostrum*, *G. tortile*, *Dicranum calcareum*, *Seligeria pusilla*, *Trichostomum tophaceum*, *T. mutabile*, *T. crispulum* and v. *elatum*, *Barbula recurvifolia*, *B. intermedia*, *Zygodon viridissimus*. *Z. Novellii*. *Ulota Bruchii*, *Orthotrichum Lyellii*, *Splachnum sphæricum*, *S. ampullaceum*, *Funaria calcarea*, *Philonotis calcarea*, *Breutelia arcuata*, *Zieria julacea*, *Bryum roseum*, *Cinclidium stygium*, *Mnium cuspidatum*, *M. affine*, *M. serratum*, *M. subglobosum*, *Fissidens crassipes*, *Cinclidotus fontinaloides*, *Fontinalis gracilis*, *Antitrichia curtipendula*, *Anomodon viticulosus* in fruit. *Pseudoleskea catenulata*, *Cylindrothecium concinnum*, *Orthothecium rufescens*, *Brachythecium rivulare*, *Eurhynchium pumilum*, *Rhynchostegium murale*, *Hypnum rugosum*, *H. virescens*, *H. giganteum*, *H. stramineum*, and *H. scorpioides*.

Hepatics.—*Marchantia polymorpha*, *Asterella hemisphærica*, *Lejeunia echinata*, *L. serpyllifolia*, *Porella rivularis*, *Cephalozia sphagni*, *Chiloscyphus polyanthus*, *Scapania æquiloba*, and *Jungermannia riparia*.

Fungi.—*Pleurotus hypnophilus*, and many common species, such as *Peziza granulata*, *P. stercorea*, *Ascobolus furfuraceus*, *Agaricus* (*Clitopilus*) *prunulus*, *A.* (*Crepidotus*) *alveolus*, *Boletus luridus*, *Phragmidium fragariastri*, *P. sanguisorbæ*, *P. subcorticatum*, *Uromyces fabæ*, *U. poæ*, *Puccinia sessilis*, *P. poarum*, *P. coronata*, *P. prenanthis*, *P. valantiæ*, *P. albescens*, and *Æcidium grossulariæ*.

Lichens.—*Leptogium lacerum*, *Ramalina calicaris*, *R. fastigiata*, *Peltigera polydactyla*, *Parmelia perlata*, *P. olivacea*, *Squamaria crassa*, *S. gelida*, *S. saxicola*, *Placodium murorum*, *Physcia tenella*, *Solorina saccata*, *S. limbata*, *Ramalina farinacea*, *Evernia prunastri*, *Lecanora rupestris*, *L. calcarea*, *Lecidea cupularis*, *L. concentrica*, *L. exanthematica*, *L. cæruleo-nigricans*, *Endocarpon miniatum* and v. *complicatum*, *E. fluviatilis*, *E. rufescens*, and *Graphis scripta*.

Algæ.—*Pediastrum angulosum*. *Cœlastrum microscopicum*, *Hormiscia zonata*, *Spirogyra nitida*, *Zonotrichia calcarea*, *Scytonema myochrous*, *Calothrix mirabilis*, *Nostoc rupestre*, *Arthrosiphon alatus*, *Chroolepus aureum*, *Meridion circulare*, *Melosira arenaria*, *Synedra ulva*, *Pleurosigma lacustre*, *Amphora ovalis*, *Encyonema cæspitosum*, *Pinnularia viridis*, *Nitzschia linearis*, *N. tenuis*, *N. Brebissonii*, and many species of Desmids, including the following:—*Gonatozygon Kinahani*, *G. Brebissonii*, *Spharozosma vertebratum*, *Staurastrum inflexum*, *S. polymorphum*, *S. gracile*. *S. tricorne*, *S. punctulatum*, *S. pygmæum*, *Euastrum pectinatum*, *E. elegans*, *Cosmarium Meneghinii*, *C. conspersum*, *C. Bæckii*, *C. homalodermum*, *C. pseudopyramidatum*. *C. granatum*, *C. crenatum*, *C. undulatum*, *C. ochthodes*, *C. botrytis*, and *C. bioculatum*.

Entomology.

Mr. J. W. Carter writes that perhaps there is no part of the Aire basin less known entomologically than the limestone districts of Malhamdale, consequently there is a wide field for investigation. With the exception of a very limited number of

universally distributed species, the following are all that are known to him to occur in the neighbourhood of Malham :—*Vanessa atalanta* and *V. io*, *Nudaria mundana*, *Chelonia plantaginis*, *Venilia maculata*, *Selenia illunaria* and *Herbula cespitalis*. The only known existing Yorkshire specimen of *Larentia ruficinctata* was taken at Malham, near the end of August, 1876, and this is one of the most likely localities in our county to produce the species in abundance. Of the other orders of insects we know nothing, and full lists of species noted, however common, will be gladly received.

Conchology.

Mr. W. Denison Roebuck, F.L.S., observes that conchologically Malham is a productive district, its limestones yielding abundance of such species as *Helix rupestris*, *H. arbustorum*, *H. lapicida*, *H. ericetorum*, *Balea perversa*, and *Clausilia dubia*. The white variety of *Ancylus fluviatilis* is found in the river Aire just where it issues from Malham Cove, and a small marsh by the side of Malham Tarn, at about 1250 ft. elevation, has yielded *Pisidium fontinale* and *P. pusillum*, *Planorbis spirorbis*, *Limnæa peregra* and *L. truncatula*, *Succinea putris*, *Zonites crystallinus*, &c. Of the three slugs reported. *Limax arborum*, is the most interesting. The other species of land shells found include *Vitrina pellucida*, *Zonites cellarius*, *Z. alliarius*, *Z. glaber*, *Z. purus*, *Helix nemoralis*, *H. hortensis*, *H. rufescens*, *H. hispida*. *H. rotundata*, *Bulimus obscurus*, *Pupa umbilicata*, *P. marginata*, *Vertigo pusilla*, *Clausilia rugosa*, *Cochlicopa tridens* and *C. lubrica*, in addition to which a few varieties have been recorded. The Mollusca of Malham Tarn are worthy of remark. The altitude (1250 feet) at which it stands is a great one at which to expect to find many species, yet it yields *Limnæa stagnalis* var. *fragilis*, *Bythinia tentaculata*, *Valvata piscinalis*, *Planorbis nautileus*, *P. contortus*, *Sphærium corneum*, and some of these, especially the *L. stagnalis*, display alternations of opaque white and transparent horn colour which have been regarded as indicative of the wide change of temperature to which the shells are exposed in so bleak a situation.

Vertebrate Zoology.

Mr. Edgar R. Waite, F.L.S., writes :—The Malham district has never been systematically worked under this section, consequently members should keep a sharp look out and record **all** species they fall in with. Embracing as it does a varied character, the district under investigation should prove a fruitful one. From Bell Busk the conveyances go up the valley of the River Aire to its source, and among other birds the Dipper, Pied, Grey, and Yellow Wagtails, Kingfisher, Heron, and Common Sandpiper should be seen. In the woods which line the route the Nightjar and Barn and Tawny Owls occur, as does also the Pied Flycatcher, a nest of which was found by Mr. E. P. P. Butterfield. The date of the excursion is, however, late for many of the warblers and other migrants. On reaching Malham Cove, (a large scar of limestone blocking the valley), innumerable Jackdaws and an occasional Stockdove will be noticed, and nearer the summit of the cliff, the Kestrel will probably be seen. This huge face of limestone is ornithologically interesting as being one of the few natural breeding places of the House Martin. A stiff climb will bring the party on to the moor where the Golden Plover, Snipe, Dunlin, Redshank, and Curlew are common. The Wheatear is to be seen on every wall, occasionally accompanied by the Ring Ouzel. Red Grouse are common on the moor, and the Partridge and Lapwing on the lower ground. The Mallard, Teal. Waterhen, Coot, Redshank, and Little Grebe nest regularly in the vicinity of Malham Tarn ; the Tufted Duck has done so, on at least one occasion. The Wood Wren is found in the wood behind Malham Tarn House at a height of 1300 feet.

But little appears to be known of the Mammals, Reptiles, and Amphibians. The fish which inhabit Malham Tarn are of interest as illustrating the effect of interbreeding in bringing about malformation. One out of every fifteen trout found is deficient of the operculum or gill cover, and the perch are subject to blindness.

Micro-Zoology and Micro-Botany.

There appears to have been no work done in respect of the micro-zoology, but the Algæ will be found treated of under ' Botany.'

Programme of Meetings.

4-0. —Meat Tea
5-0. —Sectional Meetings
5-15.—General Meeting
} All at the Buck Hotel, Malham.

6-20.—Conveyances leave Malham.
7-22.—Special Train leaves for Leeds, arriving at 8-17 p.m.

Yorkshire Naturalists' Union.

President:

PROF. A. H. GREEN, M.A., F.R.S., F.G.S., Oxford.

Hon. Secretaries:

WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.
EDGAR R. WAITE, F.L.S., Philosophical Hall, Leeds.

THE NINETIETH MEETING

WILL BE HELD AT

BRAFFERTON,

FOR THE INVESTIGATION OF

LECKBY CARR,

BALDERSBY PARK AND WOODS, CUNDALL, DISHFORTH, &c.,

On WHIT-MONDAY, May 18th, 1891.

RAILWAY ARRANGEMENTS.—Through return tickets at pleasure party fares will be issued at all Yorkshire stations on the G. N., H. & B., L. & Y., L. & N. W., M. S. & L., Mid., and N.E. Railways, which have booking arrangements for **Brafferton,** to Members and Associates of the Y.N.U. producing their signed card of Membership.

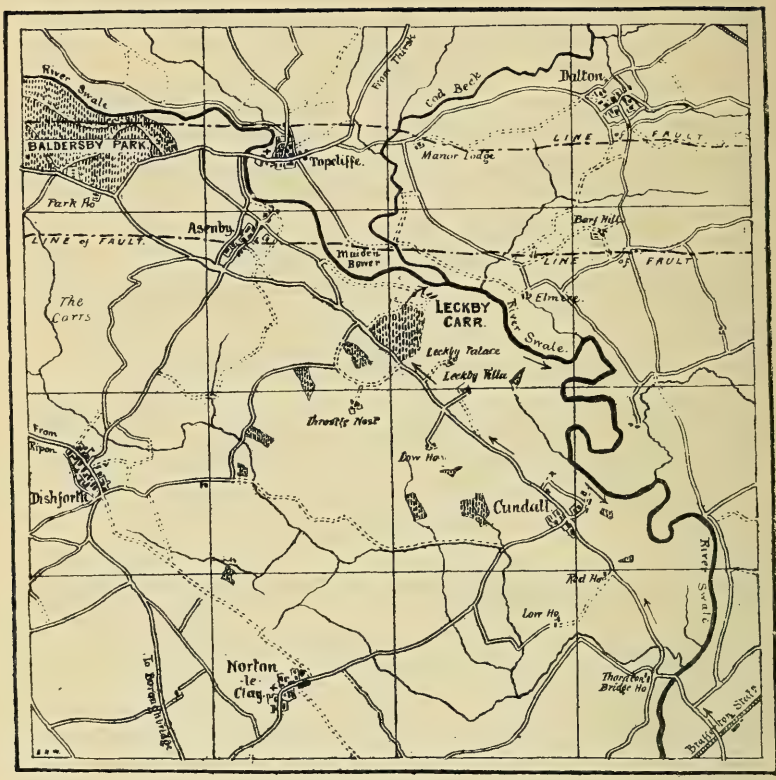
Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

PERMISSION is kindly granted by Mr. Basil T. Woodd, J.P., D.L., for Leckby Carr, and by the Dowager Lady Downe for Baldersby Park and Woods.

The permission is given, however, subject to the provisoes that nothing be done which would interfere with the game, and that rare plants, ferns, &c., be not taken up by the roots. In both respects members are desired to maintain the good reputation which the Y.N.U. has always enjoyed.

ROUTES.—Members leave Brafferton Station on the arrival of the 10-31 train from Pilmoor and will be met by Mr. T. Carter Mitchell, F.S.A., at Leckby, and under his guidance work down the right bank of the Swale to Brafferton.

BOOKS AND MAPS.—The whole field of the Excursion is included in Sheet 96 S.W., One-inch Ordnance Map (also published geologically coloured; both solid and superficial geology) and in Sheets 103 and 120 of the Six-inch Map. See also the accompanying Memoir 'On the Geology of the Country around Northallerton and Thirsk,' by Messrs. Fox-Strangways, Cameron, and Barrow. Botanical reference may be made to Grainge's 'Vale of Mowbray,' and to Baker's 'North Yorkshire' (ed. i., 1863, p. 118, and ed. ii., 1888, p. 157) for short lists of rarer plants at Leckby Carr and about Cundall.



EXPLANATION.—The Map is divided into square miles by horizontal and perpendicular lines. Brafferton Station will be found in the lower right-hand corner, and the general line of route is indicated by arrows. The shaded areas are woods and plantations. The two lines of fault are shown which are referred to in the geological paragraph opposite.

THE DISTRICT.—The river Swale is here the division between the vice-counties of North-East and North-West York, and as this Excursion is planned for *North-West* Yorkshire, members are requested to confine their investigations to the country lying south and west of, and on the right bank of, the river. Not that there is any objection to interesting records being made for North-East Yorkshire, but simply that for sake of accuracy it be clearly understood for which division the records are made.

Between Asenby and Leckby on one hand, and Dishforth on the other, is a boggy low-lying piece of country with slow-running ditches, which seems a likely place to reward the naturalist.

PHYSICAL GEOGRAPHY AND GEOLOGY.—Mr. T. Carter Mitchell, F.S.A., writes:—Leckby Carr is a wood situated in a swampy hollow within a few hundred yards of the right bank of the river Swale, but separated from that river by a ridge of hills. Originally, in all probability, this hollow had a natural drainage into the Swale. During the Ice period, a glacier, having its

origin in the hills far away to the north-west, and more or less following the course of the river, brought with it vast quantities of shingle, gravel and sand, in the form of a moraine, which when the ice disappeared on the climate becoming milder, was left as a range of gravel hills along the valley, and is nowhere better to be seen than in the neighbourhood of Leckby Carr, which it cuts off from the river. The hollow, thus converted into a shallow lake basin, in time became to a great extent filled up by the growth of aquatic plants. Around the outside of the Carr the ground is firm, and some good timber trees grow on it, but further in it has never been thoroughly drained, and is neither water nor 'good dry land.' It has been long looked upon as a 'happy hunting-ground' for the Naturalist.

In consequence of a very extensive double fault which occurred after the deposit of the Chalk, and which reaches from the East Coast to the Magnesian Limestone a few miles north of Ripon, the Lias formation still remains unremoved by denudation as far westward as the district which is to be investigated, whereas on both sides of the fault the Trias extends some miles further to the east before it underlies the Lias. I am aware that on the Geological Ordnance Map the line which is supposed to mark the southern boundary of the fault passes close to Asenby village, but I have reasons for thinking this wrong, as I have found Lias fossils considerably to the south of this line, and I am informed that in boring for water on the hill near Cundall Vicarage, the Lias was found to underlie this at a considerable depth. The district which is to be searched is one which should yield a diversity of objects of interest, as it lies on the borderland where the Keuper Sandstones of the Trias meet the limestones and shales of the Lias, the two formations being separated by a narrow belt of the Rhætic beds, which are the passage beds between the two, and partake of the character of both, but are generally considered by geologists to belong to the Trias. At Asenby Gravel Pits, about half a mile up the river, a good section of the moraine is to be seen. The great variety of rocks from which the gravel was derived is well worth noticing. They range from Silurian to New Red Sandstone inclusive, and are interspersed with pieces of Shap granite, and other igneous rocks. In one part of the narrow road between the gravel hill and the river, is seen a section of the Lias rock 'in situ,' but much ground and shattered by the glacier which crept over it. A mile further on, at Asenby stream, a good section of the Lower Lias may be seen again underlying a hill of sand and gravel. At Holme Banks, a wood running along the river-side, between Baldersby Park and Baldersby Church, there is an outcrop of the New Red Sandstone. From the Lias limestone where it forms the bed of the Swale at Asenby stream, I have obtained many fossils, including *Lima*, *Ostrea*, and other Lamellibranchs, a small Crustacean, Pentacrinite stems, Serpulæ, stools and fronds of Cycads, an Araucaria (?), and the cones of some plants. On the opposite side of the Swale to the Asenby Gravel Pits are some remarkable earthworks.

BOTANY.—Mr. Wm. Foggitt writes:—Baines in his 'Flora of Yorkshire,' published in 1840, writes, 'Leckby Carr is a point deserving special attention by the lovers of bog plants, insects, and shells. To the botanist Leckby Carr is classic ground, being the original British locality for the rare and highly interesting *Scheuchzeria palustris*, where it was first discovered in 1807 by the Rev. Jas. Dalton, one of the fathers of Yorkshire botany. Forty years ago it was tolerably abundant, but has now we fear most probably through increased drainage, become well-nigh, if not quite, extinct. *Lysimachia thyrsiflora* is still plentiful, whilst *Drosera anglica*, *D. rotundifolia*, *Vaccinium Oxycoccos*, *Carex curta*, and *Rhyncospora alba* literally abound. In the south-west corner of the Carr is a fine bed of *Calamagrostis lanceolata* and the north margin is studded with large bushes of *Rhamnus Frangula*, whilst here and there may be found *Stellaria glauca*, *Comarum palustre*, *Menyanthes trifoliata* and other marsh plants. *Sambucus Ebulus* grows in an adjacent hedge-row, and the fields in the vicinity yield *Turritis glabra*, *Malva moschata*, *Trifolium striatum*, *Poterium Sanguisorba*, *Œnanthe Phellandrium*, *Carduus marianus*, *C. eriophorus*, *Verbascum Thapsus*, *Calamintha Acinos*, *Marrubium vulgare*, *Primula farinosa*, and *Colchicum autumnale*. The Swale and its adjacent banks afford *Nasturtium sylvestre*, *Saponaria officinalis*, *Cerastium arvense*, *Gagea lutea*, *Butomus umbellatus*, and *Potamogeton perfoliatus*. Near to Cundall have been found *Thalictrum flavum*, *Trifolium arvense*, *Bupleurum rotundifolium*, *Œnanthe Lachenalii*, *Bryonia dioica*, *Centaurea Scabiosa*, *Myosotis collina*, *Humulus Lupulus*, and

Hordeum murinum. Baldersby Park is an old station for *Osmunda regalis*, whilst hard by Pouter Carr yields *Polemonium cæruleum*. The bryologist may also expect a rich harvest. Among the Mosses found in the above localities are *Tortula marginata*, *T. latifolia*, *Cinclidotus fontinaloides*, *Fissidens crassipes*, *Orthotrichum rivulare*, *O. Sprucei*, *Aulacomnium androgynum*, and abundance of Sphagna. Many of the old trees in the Carr are adorned with magnificent specimens of *Usnea barbata*.

VERTEBRATE ZOOLOGY.—Mr. T. Carter Mitchell, F.S.A., of Topcliffe, furnishes a list of vertebrated animals which have come under his own personal notice in the Topcliffe district, which includes both banks of the Swale. From this list and other available information there can be no hesitation in saying that the district is one which will well repay investigation.

Mammalia.—The Squirrel is common in Baldersby Park, where also a herd of Fallow Deer is kept. A Badger was obtained there in 1883. The Otter is not uncommon in the Swale. The Noctule, Pipistrelle, and Long-eared Bats all occur in the locality; but all Mammals seen should be recorded, the district never having been thoroughly investigated.

Birds.—There are some fine old trees in Baldersby Park to attract such birds as the Nuthatch, Green and Great Spotted Woodpeckers, Jay, Long-eared and Tawny Owls. The Nightjar occurs, but it is doubtful if it will have arrived by the date of the excursion. Snipe will be met with in the marshy ground about Leckby Carr, and no doubt Sandpipers will be found on the river banks. Among birds occasionally seen in the district may be mentioned Quail, Heron, Hawfinch, Goldfinch, Nightingale, and Grasshopper Warbler. Several accidental visitors have been taken, such as the Great Northern and Red-throated Divers, Gannet and Puffin, but it is not likely that such birds as these will detain the party on Whit Monday.

Amphibia.—It is hoped that conchologists and others who have occasion to examine the ponds will preserve for identification any Newts they may obtain.

Fishes.—Mr. Mitchell gives the following list of fishes for the district:—Trout, Grayling, Pike, Perch, Ruff, Barbel, Chub, Roach, Dace, Sharp-nosed and Broad-nosed Eels, Lampern, Bleak, Minnow, Stickleback, Loach, Bullhead, Burbot, Tench, Gudgeon, Salmon, and Sea Trout.

ENTOMOLOGY.—No attention appears to have been paid to the insect-fauna of the area to be visited. Entomologists are recommended to work the woods at Leckby Carr, etc.

CONCHOLOGY.—As by far the greater portion of the vice-county North-West Yorkshire is hill-country, this portion of it—the flattest and lowest-lying—deserves careful investigation with the view of adding to the recorded fauna of the vice-county, especially as no records appear to be extant, and there is no evidence that a conchologist has ever visited the district.

Mr. J. H. Davies (author of the Thirsk List of Shells, 1855) is of opinion that the district will be found rich in freshwater mollusca, and has obtained *Planorbis corneus* commonly in ponds near Topcliffe, north of the Swale.

MICRO-ZOOLOGY AND MICRO-BOTANY.—There appears to be no information under this heading.

AMATEUR PHOTOGRAPHERS are requested to take some of the fine trees in Baldersby Park, and if accompanying the Geological Section it is hoped that any interesting exposures may be subjected to the lens.

'Dark Rooms' for changing plates are provided at Asenby (Mr. Metcalfe, Registrar), and Baldersby Park Lodge. Charge to members showing cards, 6d.

PROGRAMME OF MEETINGS.—

5-30 p.m.—Meat Tea, 2/- each, at the 'Golden Lion,' Helperby.
6-30 p.m.—Sectional Meetings } Mechanics' Institute and Coffee Rooms,
7- 0 p.m.—General Meeting } Helperby.

It should be noted that Helperby and Brafferton are practically one and the same village, for which Brafferton is the railway station.

Yorkshire Naturalists' Union.

President:
PROF. A. H. GREEN, M.A., F.R.S., F.G.S., Oxford.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.
EDGAR R. WAITE, F.L.S., Philosophical Hall, Leeds.

THE NINETY-FIRST MEETING

WILL BE HELD AT

GRASSINGTON,

FOR THE INVESTIGATION OF

GRASS WOOD,

GHAISTRILLS, The 'REEF-KNOLLS' about CRACOE and THORPE, ELBOLTON CAVE, Etc.,

On SATURDAY, June 20th, 1891.

RAILWAY ARRANGEMENTS.—Return tickets at pleasure party fares issued at all Yorkshire stations on the G.N., H. & B., L. & Y., L. & N.W., M.S. & L., Mid., and N.E. Railways, for **SKIPTON,** to Members and Associates producing signed card of Membership. Tickets available for return Monday or Tuesday.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

PERMISSION is kindly granted by the Duke of Devonshire and Messrs. James Lambert, N. H. Kelsall, Robert Procter, and W. A. Procter.

The permission is given, however, subject to the provisoes that nothing be done which would interfere with the game, and that no plants, ferns, etc. be taken up by the roots. In both respects members are desired to maintain the good reputation which the Y.N.U. has always enjoyed.

HOTEL ACCOMMODATION.—Members intending to stay over Sunday will find accommodation at Grassington House, the various Inns at Grassington, The Old Hall Inn at Threshfield, The Devonshire at Cracoe, etc. Charges, from Saturday (tea) to Monday (breakfast) inclusive:—Grassington House, Grassington, 14-; Old Hall Inn, Threshfield, 9/6. Early application will be necessary to secure accommodation, as numerous members have already intimated their intention of staying over the week-end.

CONVEYANCES will leave Skipton Station at 9-30 a.m., reaching Grassington about 11 a.m. In case parties of members wish to follow at a later hour, Mr. Smith will arrange for conveyances and for their being accompanied by local members. Charge for return journey, 2/3 (including driver's fee), to members sending definite order to Mr. C. C. Smith, Hon. Sec. Craven Naturalists' Association, 10, Brook Street, Skipton, not later than the 18th June.

No further responsibility is undertaken either by Mr. Smith or the Secretaries of the Union, and members not ordering seats must be content to make their own arrangements on arrival at Skipton.

CIRC. 91.

ROUTES.—

I.—GEOLOGICAL, under the leadership of Mr. R. H. Tiddeman, M.A., F.G.S., leaving the conveyances at Cracoe, will proceed to Skelterton, Stebden, Thorpe, and Burnsall, examining the limestone knolls on the way, and returning to Grassington by the river.

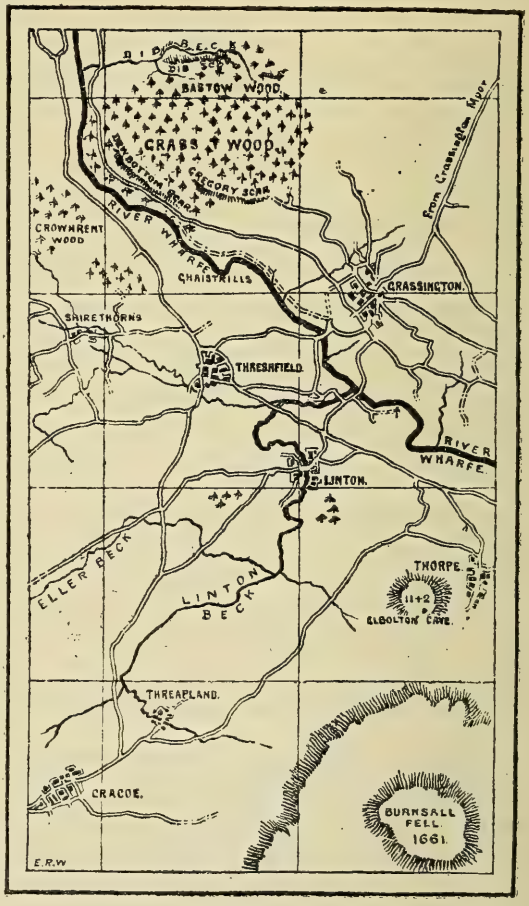
II.—Members wishing to inspect Elbolton Cave must send in their names to Mr. C. C. Smith before the 18th inst.

III.—A party, under the leadership of prominent members of the Craven Naturalists' Association, will direct their investigations chiefly to Grass Wood and the adjoining river-banks, which will be sure to repay all the attention that can be paid to it.

EXPLANATION.—The Map is divided into square miles by horizontal and perpendicular lines.

BOOKS & MAPS.

—The whole field of the Excursion is included in Sheet 61 (92 N.E.) One-inch Ordnance Map (also published geologically coloured), and in Sheet 134 of the Six-inch Map. The following works may be consulted: (1), R. H. Tiddeman, M.A., F.G.S, 'Physical History of the Carboniferous Rocks of Upper Airedale,' (Proc. Yorks. Geol. and Polyt. Soc., 1891, vol. xi., part iii, p. 353); (2), L. C. Miall, F.G.S., F.L.S., 'Geology, Natural History, and Pre-historic Antiquities of Craven'; (3), Windsor's 'Flora Cravoniensis'; (4), Davis and Lees' 'West Yorkshire,' pp. 309—311; (5), Lees' 'Flora of West Yorkshire'; (6), A List of the Fauna was published in the 'Leeds Mercury Weekly Supplement,' July, 1882; (7), Copies of the Circular of the Y.N.U. Excursion to Grassington, Aug., 1882, may still be had, 3d. each; (8), Report of same, in 'Naturalist,' Sep. 1882, viii, 30; (9), J. R. Dakyns, 'On the Changes of the Lower Carboniferous Rocks in Yorkshire from North to South' (Proc. Yorks. Geol. and Polyt. Soc., 1891, vol. xi., p. 353).



GEOLOGY.—Mr. R. H. Tiddeman, M.A., F.G.S., writes: The journey from Skipton to Grassington will give a good idea of the general aspect of the Lower Carboniferous rocks on the south side of the Craven Faults. The following will be visible and most of them traversed:—

ROCK.	LOCALITY.
Millstone Grits	Cracoe and Rylstone Fells.
Bowland Shales...	On the slopes beneath.
Pendleside Limestone	From Cracoe to Thorpe.
Shales with Impure Limestones.	Not well seen.
Clitheroe Limestones	Haw Park, Skipton, and Rylstone Vicarage.

Bowland Shales give place to the Yoredale series on the north side of the Faults beyond Grassington, though this is not so well developed as in the country to the north-west, and the Limestone on the north side is one undivided mass, the 'Shales-with-Limestones' being absent. The most interesting feature in the expedition, so far as geology is concerned, is the curious arrangement of the Pendleside Limestone in conical mounds near Cracoe. These are full of well-preserved fossils, and there is much probability of their having been formed as reefs on a sinking sea-bottom from the growth and death of organisms.

BOTANY.—Mr. L. Rotheray states that the district offers a rich and varied field to the botanist, owing in a great measure to its being situated on the mountain or carboniferous limestone, the scars of which offer a good and safe habitat for many rare and interesting species of limestone-loving plants. Especially so at Grass Wood, an old and very extensive piece of woodland, well stocked with trees and shrubs, thickly interspersed with an undergrowth of smaller plants and grass, amongst which are scattered various outcrops of the limestone; this is intersected with crevices, in which many of the rarer montane species find a home. In such places will be found *Thalictrum minus* var. *montanum*, *Draba incara*, *Spiræa filipendula*, *Helianthemum vulgare*, *Rubus saxatile*, *R. cæsius*, *Hippocrepis*, *Hypericum hirsutum*, *Geranium sanguineum*, *Rosa mollis*, *Epilobium augustifolium*, *Hieracium murorum*, *H. maculatum*, *Polemonium*, *Armeria maritimum*, *Taxus*, *Tamus*, *Paris*, *Polygonatum officinale*, *Convallaria*, *Allium scorodoprasum*, *Asplenium viride*, *Polypodium dryopteris*, whilst the following occur in the more grassy and open parts, especially if at all of a moist nature: *Trollius*, *Sagina nodosa*, *Calamintha clinopodium*, *Galeobdolon*, *Primula farinosa*, *Trientalis*, *Rumex aquaticus*, *Ophrys muscifera*, and *Gymnadinia conopsia*. On dry banks, both in the wood and in the lanes and pastures: *Aquilegia*, *Viola odorata*, *V. lutea*, *Alsine verna*, *Geranium sylvaticum*, *Thlaspi alpestre* v. *occitanum*, *Silene inflata*, *Cnicus heterophyllus*, *Centaurea scabiosa*, *Melampyrum pratense*, *Origanum*, *Avena pratensis*, *Koeleria*, *Brachypodium sylvaticum*, *Triticum caninum*, and others are to be found. Careful attention also deserves to be paid to the river banks in the vicinity of the village. Here are *Salix phylicifolia*, *S. laurinas*, *Equisetum sylvaticum*, *Scirpus pauciflorus*, and *Carex muricata*, and it is very probable that a careful investigation of both sides of the river banks may yield other species which have not yet been recorded for the district. When the varied nature of the ground and its conformation is taken into consideration, the above list does not at all yield a sufficient return for such a wide district, and it is not expressing too much to say that many more species ought to be found than are now given if a searching investigation be made of it. As, however, the lateness of the season has in a great measure retarded the flowering of the plants, it is very probable that only a very few, comparatively speaking, may be met with in that state.

Fungi.—Mr. H. T. Soppitt writes: Upper Wharfedale is fairly rich in Fungi, especially *Uredineæ*, of which many species have been found during the past few years between Barden and Grass Woods. The Æcidium condition of several interesting species will be found by specially looking for such as *Puccinia phalaridis* on *Arum maculatum*, *P. sessilis* on *Allium ursinum*, *P. variabilis* on *Taraxacum officinale*, and *P. sanicula* on *Sanicula europæa*. *Xenodochus carbonarius* is abundant in Grass Wood in Burnet, as is also *Puccinia andersoni* on *Carduus heterophyllus*, while *Phragmidium sanguisorbæ* is not uncommon on *Poterium sanguisorbæ* in the fields.

Mosses and Hepatics, Lichens, and Algæ, do not appear as yet to have been investigated in the district.

VERTEBRATE ZOOLOGY.—It is surprising to find that so prolific and interesting a district should have received so small an amount of attention as the following paragraphs attest.

Mammalia.—Numerous species have already been recorded; the Squirrel is common in Grass Wood, and it would be interesting to ascertain if the Dormouse occurs. Otters are not uncommon in the Wharfe; the Badger has been taken so near as Simon Seat, and the Pine Marten at Buckden so recently as 1880.

Birds.—Woodland and subalpine species are common, including Barn, Tawny, and Short-eared Owls, Grey Wagtail, Curlew, Ring Ouzel, Stonechat, Dotterel, Snow Bunting, &c., while the Raven and Peregrine nested in Upper Wharfedale to within comparatively recent times, and in 1876 a Bittern was shot near Grass Wood.

Reptiles, Amphibians, and Fishes.—The Common Lizard, Frog, Toad, Trout, are all the species at present on record. It is stated that Vipers are *not* found in Grass Wood.

ENTOMOLOGY.—Although but scant attention has been paid to the insect-fauna of Upper Wharfedale, and no list has ever been published, enough is known to warrant our saying that entomologists may expect to be well rewarded in Grass Wood. Here at the proper season *Erebia blandina* flies in myriads, and on the occasion of the last visit of the Union *Miana expolita* was added to the Yorkshire list.

CONCHOLOGY.—Mr. W. Denison Roebuck, F.L.S., writes that the molluscan fauna of the neighbourhood of Grassington, Thorpe and Cracoe is very rich in terrestrial mollusca, being well-wooded and predominantly calcareous in character, the abundance of such species as *Limax arborum*, *Helix rupestris*, *Balea*, *Clausilia dubia*, *Cl. laminata*, *Helix arbustorum*, *H. ericetorum*, *Bulimus obscurus*, *Azeca*, etc., being ample evidence. Of other species, *Cyclostoma* has been reported from a bank between Grassington and Burnsall, a few yards from the river, *Pupa secale* occurs at Kettlewell, and *Helix lapicida* at Starbotton, Kilnsey, and Troller's Gill, and these should all be looked for in the more immediate neighbourhood of Grassington and Grass Woods. *Ancylus fluviatilis*, *Planorbis spirorbis*, *Limnæa peregra*, *L. palustris*, *L. truncatula*, and *Pisidium fontinale*, are the only water shells that have been recorded for Upper Wharfedale, but mostly higher up than Grassington. Altogether about 43 species are on record for the district, a rich fauna for so elevated an area. The chief attention of the conchologist should now be directed to a careful search of Grass Woods and other likely stations in the hope finding such species as *Helix lamellata*, *H. aculeata*, *H. pulchella*, *Zonites purus*, *Z. nitidus*, *H. sericea*, *H. caperata*, *H. pygmæa*, *H. pulchella*, *Pupa ringens*, *P. marginata*, or any species of *Vertigo*, *Achatina*, and *Acme*, none of which have been as yet reported, but all are within the bounds of possibility as likely to occur. Attention should also be given to increasing the lists of slugs and freshwater forms.

MICRO-ZOOLOGY AND MICRO-BOTANY.—No attention whatever seems to have been given to these subjects.

AMATEUR PHOTOGRAPHERS will find numerous subjects, and those accompanying the geologists will do well to take some of the sections exposed on Mr. Tiddeman's line of route.

'Dark Rooms' for changing plates are provided at Grassington (Grassington House), Threshfield (Old Hall Inn), Thorpe (Mrs. Waite, Holly Tree House), and Skirethorns (Mr. James Lambert). Charge to Members showing cards, 6d.

PROGRAMME OF MEETINGS.—

4- 0 p.m.—Meat Tea, 2/- each
5- 0 p.m.—Sectional Meetings
5-30 p.m.—General Meeting
} All at Grassington House, Grassington.

6-30 p.m.—Conveyances leave Grassington.
8- 6 p.m.—Train leaves Skipton for the South.

Yorkshire Naturalists' Union.

President:
PROF. A. H. GREEN, M.A., F.R.S., F.G.S., Oxford.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.
EDGAR R. WAITE, F.L.S., Philosophical Hall, Leeds.

THE NINETY-SECOND MEETING

WILL BE HELD AT

HAYBURN WYKE,

FOR THE INVESTIGATION OF

HAYBURN BECK, STAINTONDALE, CLOUGHTON MOOR AND WYKE, AND THE UNDERCLIFFS FROM HAYBURN WYKE TO PEAK.

On SATURDAY, JULY 11th, 1891.

RAILWAY ARRANGEMENTS.—Return tickets at pleasure party fares issued at all Yorkshire stations on the G.N., H. & B., L. & Y., L. & N.W., M.S. & L., Mid., and N.E. Railys., for **HAYBURN WYKE**, to Members and Associates producing signed card of Membership. Tickets available for return Monday or Tuesday.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

PERMISSION is kindly granted by Mr. J. W. Woodall, M.A., J.P.

HOTEL ACCOMMODATION.—Members intending to stay over Sunday will find accommodation at the Hayburn Wyke Hotel.

ROUTES.—Start on arrival of train leaving Scarborough at 10-40 a.m.

I.—Geologists should leave the train at Cloughton and work the district northward to Hayburn Wyke.

II.—Mr. Edward R. Cross will lead a botanical party from Cloughton Station through Cloughton, and on to Ringing Keld Bog, then crossing the moors to Hayburn Wyke.

III.—A party under the care of Mr. W. J. Clarke, will work from Hayburn Wyke Station up Staintondale, crossing to the coast and returning by the undercliff. Members accompanying this party will have to be prepared to do some stiff climbing.

BOOKS & MAPS.—The whole field of Excursion included in Sheet 44 (95 N.W.) One-inch Ordnance Map (also published geologically coloured), and in Sheet 62 and a small portion (the Peak) in Sheet 47 of the Six-inch Map. The following works may be consulted:—'The Geology of the Country between Whitby and Scarborough,' by C. Fox Strangways and G. Barrow; W. H. Hudleston, 'Yorkshire Oolites,' Proc. Geol. Ass., 1874, iii, 310—315. Botanical reference may be made to Baker's 'North Yorkshire,' Ed. I., p. 153, and Ed. II., p. 198.

MAP.—A map has been prepared, but having been omitted for want of space, copies will be supplied to all attending the excursion or sending Mr. Waite a stamped addressed envelope.

GEOLOGY.—Mr. C. Fox Strangways, F.G.S., writes:—Starting from the south side of Cloughton Wyke we find the highest beds with which we have to deal during this excursion, and walking northwards we pass over lower strata in regular succession. Descending the cliff at Hundale Point the basement beds of the Upper Estuarine Series are met with, and immediately below we come upon a fine section of the Grey Limestone Series which here occupies the greater part of the cliff and forms the fine reef of rocks known as Hundale Scar. Beneath this and forming the cliffs encircling the little bay are the Middle Estuarine Series with plant remains and thin seams of coal, among which the palæo-botanist may find much to interest him. At the base of this series the Millepore Bed comes up and forms a somewhat conspicuous scar of red irony rock on the north side of the Wyke. This section is interesting on account of its being the most northerly really good exposure of the rock there is before it finally thins out in that direction. Ascending the undercliff just beyond this point we may follow these beds along the upper cliff as far as Hayburn Wyke. In the cliff below and at Iron Scar the Eller Beck Bed may be obscurely seen. At Hayburn Wyke a slight disturbance of the rock may be observed on the shore, but whether this indicates the presence of a fault is uncertain. North of this the cliffs become more lofty and of more interest to the botanist than to the geologist. Descending these cliffs by the path below Peak Station a magnificent section is seen from the top of the Grey Limestone to the base of the Oolites and each bed may be examined in detail for a thickness of over 600 feet. Between this point and Peak the sections are of great interest from the fine exposures of the Dogger, Blea Wyke Beds, and upper part of the Lias. Ascending the cliff at Peak a fine section is seen of the Peak Fault which has a throw of 400 feet and brings the Dogger against the margaritatus beds of the Middle Lias. The hade or inclination of the fault is very clearly shown along the line taken by the footpath.

BOTANY.—Mr. Edward R. Cross states that Hayburn Wyke should prove a capital district for botanists, as—the present railway only having been opened some five or six years—it has never been properly worked, the difficulties of reaching it preventing this. However, the botanical wealth of the neighbourhood is shown by a goodly number of plants having already been recorded.

In the pretty Wyke itself *Inula Helenium* grows in abundance, whilst *Parnassia* lightens up every damp spot with its beautiful snowy-white blossoms, accompanied by *Habenaria viridis*, *Triglochin maritimum*, and *Equisetum hyemale*. Near the little brook which here runs into the sea *Hymenophyllum tunbridgense* is said to occur, whilst *Orchis pyramidalis*, *O. morio*, *O. latifolia*, *Habenaria conopsea*, and *Epipactis palustris* should be found. The cliffs towards the south are covered earlier in the year by masses of the pretty white *Cochlearia officinalis*, now in fruit, whilst *Vicia sativa* should now be looking its best with its beautiful clustered blossoms, making the cliffs well worth a visit on this account alone. Here also will be seen *Asplenium marinum*, thriving in the often inaccessible crevices of the cliffs.

Towards the North the exceedingly showy *Cephalanthera ensifolia* occurs, and in one or two large ponds there are fine specimens of *Nymphæa alba*. Spread pretty generally are *Genista tinctoria*, *Blackstonia*, *Melilotus officinalis*, and *Scolopendrium*.

On Cloughton Moors and the road leading to them *Spiræa salicifolia* grows in great profusion and is exceedingly well established. The bogs here are especially worth a thorough investigation. Several of the willows occur in them, and at this time they should be all aglow with *Narthecium ossifragum*. *Anagallis tenella*, *Myrica*, *Drosera rotundifolia*, and *Pinguicula vulgaris* also occur. The Moor itself should yield *Botrychium Lunaria*, *Listera cordata*, and some of the *Lycopodiums*, although none of these have been recorded. Near here at one time grew *Osmunda regalis*—a rediscovery of which would be very satisfactory. On the road side *Myrrhis odorata* is plentiful and the woods near the bog are likely places for *Pyrola minor*, *P. media*, and many other species. As the time of the visit is the very best for the district, in addition to the above many unrecorded species should be added to the list.

Mosses and Hepatics.—Mr. M. B. Slater, F.L.S., writes that he has only once searched for mosses at Hayburn Wyke, in October, 1886, when he met with the following:—Mosses—*Hypnum cupressiforme*, *Brachythecium velutinum*, *Rhynchostegium confertum*, *Ulota bruchii*, *Dicranum majus*, *Brachyodus trichodes*; Hepatics—*Scapania umbrosa*, *S. purpurascens*, *Cephalozia lammersiana*, *C. bicuspidata*, *Nardia hyalina*, *Frullania dilatata*, *Kantia trichomanis*, *Diplophyllum albicans*. The rare moss *Campylostelium saxicola* grows in shady places on sandstone near Hackness, and also occurs on the coast further north, and should be looked for on the shady sandstone by the stream side at Hayburn Wyke.

The best ground at this season to look for Mosses and Hepatics will be in the wood near the mouth of the stream, on the trees and rocks, and also by the stream side, in the shady places up the beck towards Staintondale.

Lichens, Fungi and Algæ.—Mr. George E. Massee, F.R.M.S., says that the following are all the things, other than those of general occurrence, which have been localised from Hayburn Wyke and its immediate vicinity: Algæ—*Dermocarpa prasina*, *D. lieblinie*, *Chlorochytrium immersum*, *Monostroma grevillii*, *Cladophora hutchinsiæ*, *C. rupestris*, *Dictyosiphon hippuroides*, *Stictyosiphon tortilis*, *Laminaria saccharina* forma *phyllitis*, *Euthora cristata*, *Spermothamnion turneri*, *Antithamnion plumula*, *Melobesia laminariæ*. Fungi—*Agaricus (Pilosace) algeriensis*, found under bushes in the ravine, the only known European habitat; superficially resembling the common mushroom, but without a ring; *Agaricus (Stropharia) albocyaneus* and *Boletus æstivalis* also occur.

VERTEBRATE ZOOLOGY.—Mr. Chas. D. Head supplies the following:

Mammalia.—Two species of Bats only have been recorded, the Noctule and Pipistrelle; the Weasel and Stoat are common, especially in the fir woods above Cloughton; five Polecats were recently seen on the moors above Staintondale, only one being killed at the time the chances of this species still occurring in the district are good. The Badger has been recorded for Hayburn Wyke; the whole district from Cloughton to Beast Cliff is overrun with Foxes, but so difficult of investigation is the latter locality that although so many as five have been heard barking in different parts of the undercliff not one could be seen. The Porpoise has several times been picked up on the beach, and a Whale (believed to be the Rorqual) was seen so recently as 1888. The Hedgehog, Mole, Shrew, Water Shrew, Brown Rat, Domestic Mouse, Long-tailed Field Mouse, Water Vole, and Field Vole have all been recorded for the district. A sharp look out should be kept for the Dormouse and Bank Vole, as both these species are likely to occur.

Birds.—Only about 87 species have been recorded for the district at present, but among these several will be found of interest. In the steep cliffs just beyond Cloughton Wyke the Herring Gull breeds pretty numerously, and an odd pair of Kestrels generally rear their young, whilst all along the lower parts of the cliff the House Martins' nests will be seen. The Herring Gull and Cormorant both breed at the Peak, and a nest of the Rock Pipit was taken there in 1890. Rumours are afloat of the Raven still frequenting these cliffs, but unfortunately no reliable evidence is at hand at present. The Magpie and Carrion Crow are exceptionally common in nearly all the wooded parts of this district. A curious fact with regard to the nesting of the latter bird has been noticed in Hayburn Wyke and Beast Cliff, where they frequently place their nest in a small tree not more than fifteen or twenty feet from the ground. The Jay has almost disappeared from the district. The Dipper, Grey and Pied Wagtails, breed along the Becks. The Willow Warbler, Chiffchaff, Blackcap, Garden Warbler, Redstart, Wheatear, Whinchat, Spotted Flycatcher, Goldcrest, Blue Tit, Great Tit, Marsh Tit, and Long-tailed Tit are all fairly common, the Wood Warbler and Tree Creeper scarce. The Stonechat, Ring Ouzel, Twite, Curlew, and Golden Plover, although unrecorded at present, will probably be found to nest on the Cloughton Moors. The Merlin, Sparrow Hawk, Long-eared, Short-eared, and Tawny Owls and Heron have all been recorded in the district. In addition to these, Mr. W. Cyngell records the Rock Dove, Stock Dove, and Ring Plover. He remarks that a look out should be kept for the Great Spotted Woodpecker, Turtle Dove (see 'Naturalist' for July), Pied Flycatcher, and Lesser Whitethroat.

Reptiles and Amphibians.—Mr. Head continues: If the day be fine and sunny the Viper, Blindworm, and Common Lizard are pretty sure to be seen on the Moors and the Viper also in Beast Cliff. It has been reported that the Grass Snake has been seen in Beast Cliff, but this requires authenticating. The Frog, Toad, and Smooth Newt are the only amphibians on record at present. The Crested Newt should be looked for in the ponds at Beast Cliff.

ENTOMOLOGY.—Mr. James H. Rowntree writes:—

Lepidoptera.—On Cloughton Moor the following species of Lepidoptera used to occur in abundance: *Argynnis aglaia*, *A. selene*, *Melanthia albicillata*. In the neighbourhood of Hayburn Wyke, particularly on the sea cliffs to the south, the undermentioned may be met with either in the larval or perfect state: *Thanaos tages*, *Hesperia sylvanus*, *Macroglossa stellatarum*, several species of *Hepialus*, *Zygæna loniceræ*, *Z. filipendulæ*, *Euthemonia russula*, *Chelonia plantaginis*, *Strenia clathrata*, *Eubolia mensuraria*, *E. bipunctaria*, *Notodonta dictæa*, *N. ziczac*, *Calocampa exoleta*, *Heliothis marginata* (larvæ on *Ononis arvensis*), *Toxocampa pastinum*, and *Euclida glyphica*. The late Mr. Thomas Wilkinson records the following *Tineæ* as occurring on Cloughton Moor on cliffs: *Cemiostoma lotella*, *Trifurcula immundella*, and *Pterophorus lithodactylus*.

Coleoptera.—Rev. W, C. Hey says the most interesting species is *Cossonus tardii*, in dead holly-wood. Characteristic marine species, e.g., *Cercyon littoralis*, *Cafius xantholoma*, on the shore. The mossy bogs on the moor near have been carefully searched and yielded many rarities.

CONCHOLOGY.—Mr. J. A. Hargreaves remarks that search should be made for *Pupa ringens*, *P. marginata*, *Vertigo antivertigo*, *V. edentula*, *V. pusilla*, *Helix aculeata*, *H. lamellata* and *H. ericetorum*, *Zonites purus* var. *margaritacea*, *Z. fulvus*, and *Z. radiatulus*, *Bulimus obscurus*, *Clausilia laminata*, *Helix fusca*, *H. concinna* and *H. pulchella*, all of which have been recently found in the neighbouring districts.

Mr. W. Nelson, Crossgates, Leeds, is now one of the Secretaries, in succession to Mr. John Emmet, F.L.S., who has resigned in consequence of not very robust health.

MICRO-ZOOLOGY AND MICRO-BOTANY.—No attention whatever seems to have been given to these subjects. The two ponds on the undercliff marked on the map, several ponds on Cloughton Moor, and Ringing Keld Pond near Cloughton Station, will no doubt repay investigation.

MARINE ZOOLOGY AND BOTANY.—The most convenient parts of the coast for investigation are the Wykes of Hayburn and Cloughton, both of which should yield good results. The tide is favourable, low water about 2 p.m.

AMATEUR PHOTOGRAPHERS will find this a picturesque district, and those accompanying the geologists will do well to take some of the sections exposed along the line of route. '**Dark Rooms**' for changing plates are provided at the 'Blacksmiths' Arms,' Cloughton (Mrs. Robinson); and at Hayburn Wyke Hotel. Charge to members showing cards, 6d.

LISTS OF THE FAUNA AND FLORA of the district, which comprises the drainage area of Staintondale and Hayburn Becks and the coast line from Peak to Hundale Point, as shown on the Map, are in preparation by members of the Scarborough Naturalists' Society, and therefore it is advisable that all reliable information, fragmentary or otherwise, be supplied at the Sectional Meetings.

PROGRAMME OF MEETINGS.—

5-30 p.m.—Meat Tea, 2/- each
6-30 p.m.—Sectional Meetings
7- 0 p.m.—General Meeting
} All at the Hayburn Wyke Hotel.
7-28 p.m.—Train leaves for Scarborough.

The next Meeting will be on Bank-Holiday Monday, August 3rd, at Sledmere.

Yorkshire Naturalists' Union.

President:
PROF. A. H. GREEN, M.A., F.R.S., F.G.S., Oxford.

Hon. Secretaries:
WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.
EDGAR R. WAITE, F.L.S., Philosophical Hall, Leeds.

THE NINETY-THIRD MEETING

WILL BE HELD AT

WETWANG,

FOR THE INVESTIGATION OF

YORK DALE and SLEDMERE

ON

Bank-Holiday MONDAY, Aug. 3, 1891.

RAILWAY ARRANGEMENTS.—Return tickets at pleasure party fares issued at all Yorkshire stations on the G.N., H. & B., L. & Y., L. & N.W., M.S. & L., Mid., and N.E. Railways, for **WETWANG** or **SLEDMERE**, to Members and Associates producing signed card of Membership. Those wishing to spend the week-end may book on Saturday.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

PERMISSION is kindly granted by Sir Tatton Sykes, Bart., and Y. Lloyd Greame, Esq.

HOTEL ACCOMMODATION.—Members intending to stay over the week-end will find accommodation at the inns at Wetwang or Sledmere.

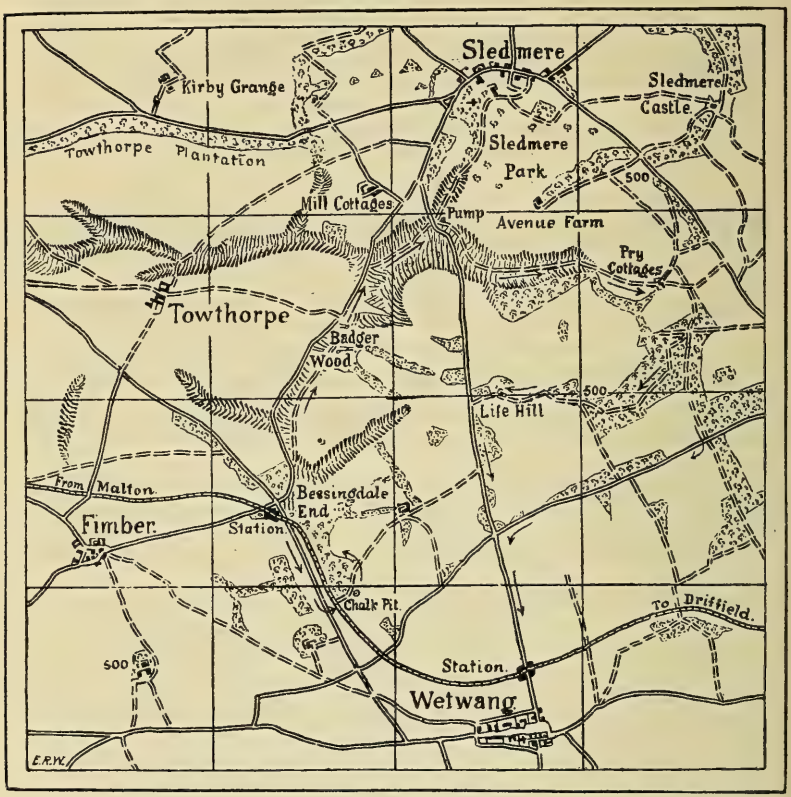
ROUTES.—Members will proceed from Fimber Station at 11-20 a.m., and will work up York Dale, through Badger Wood, and back to Wetwang, under the guidance of the Rev. E. Maule Cole, M.A., F.G.S. Those arriving at Fimber by earlier trains should occupy the time by investigating the woods at Bessingdale End as far as the chalk pit.

BOOKS and MAPS.—The whole field of Excursion is included in Sheet 64 (94 N.W.) One-inch Ordnance Map (also published geologically coloured), and in Sheets 143 and 160 of the Six-inch Map. The Memoir of the Geological Survey is entitled: 'The Geology of the Country around Driffield,' by J. R. Dakyns, M.A., and C. Fox-Strangways, F.G.S. Dr. H. F. Parsons' 'Moss Flora of the East Riding', 1878 (Trans. Y.N.U., parts ii. and iv., pp. 51—61), and Dr. Spruce's 'List of Hepaticæ of the East Riding,' 1879 (Id., part iv., pp. 62—63) should be consulted.

THE DISTRICT.—The district to be examined consists of the drainage basin of York Dale, between Fimber Station and Sledmere, which presents as charming a picture of wold scenery as heart can desire. Beautiful woods of Larch, Spruce, and Beech, clothe the sides of the dales, intermixed at the base with Lilacs, Laburnums, and other flowering trees. In the early spring the ground is carpeted with Primroses, Woodsorrel, Sweet Violets, and Lilies of the Valley, whilst later on the Wild Strawberry appears in profusion. Stepping out of the train at Fimber Station we are landed at once on classic ground (at least it would have been classic if any of the old Britons had written about it) for one of their entrenchments runs right under the station, whilst the hill opposite, Towthorpe Hill, has extensive

fortifications, which radiate in all directions. Doubtless many a struggle took place on this spot, till the Romans drove two roads right through the British earthworks—one from Malton to Beverley, the other from York to Bridlington—and subdued the country. Half-a-mile to the right, on the site of the railway, between Fimber and Wetwang, is a Romano-British Cemetery, discovered by Mr. J. R. Mortimer, in 1873.

EXPLANATION.—The Map is divided into square miles by horizontal and perpendicular lines. The arrows show the line of route.



GEOLOGY.—The Rev. E. Maule Cole, M.A., F.G.S., writes:—The subsoil is wholly chalk, but whilst the chalk-pits on the left hand side going up York Dale belong to the Middle Chalk and contain flint, those on the right hand side consist of Upper Chalk without flint. From this point the Upper Chalk extends in an easterly direction to Flamborough Head, and southwards to the village of Wetwang, the northern slopes of which are on the Upper Chalk, the southern on the Middle. The Upper Chalk is fairly fossiliferous here, especially in the matter of sponges, but the Middle Chalk is comparatively barren. A geological feature of interest is the accumulation of chalk debris, locally called 'grut,' on many of the dale sides exposed to the north and east, which, whatever may be the theory of its deposition, is certainly indicative of an arctic condition of climate. In one of the dales to be traversed the work of a local glacier can very fairly be traced.

BOTANY.—Mr. M. B. Slater, F.L.S., states that the botanical ramble is entirely through a chalk district, and there is no record of its Flora. The Rev. E. M. Cole met with *Saxifraga granulata* last year at Towthorpe; this plant will now be past its flowering time. The following are a few of the rarer and

other plants that have been gathered in various other parts of the Wold Chalk districts, some of which may possibly be met with on this occasion. **Flowering Plants:** *Malva moschata, Geranium columbinum, Ononis spinosa, Anthyllis vulneraria, Astragalus Hypoglottis, Spiræa filipendula, Poterium Sanguisorba* (abundant), *Conium maculatum, Daucus Carota, Scabiosa arvensis, Reseda luteola, R. lutea, Cnicus lanceolatus, C. palustris, C. eriophorus, Centaurea Scabiosa, Cichorium Intybus, Campanula glomerata, Lycopsis arvensis, Echium vulgare, Hyoscyamus niger, Orchis pyramidalis, Ophrys apifera.* **Grasses:** *Bromus erectus, Brachypodium pinnatum, Phleum pratense, Festuca ovina,* etc. **Ferns:** In the woods, *Lastrea dilatata* the most plentiful fern of the district, *Lastrea filix-mas, L. spinulosa,* and *Athyrium filix-fœmina* may possibly also be seen.

There are fine plantations of Larch and other Firs on the hill sides of York Dale, some few hard-wooded trees mixed with them, mostly Beech, which grows with luxuriance on the Chalk. At the outer boundaries of these plantations, as one walks up the Dale, may be seen some fine examples of our indigenous trees and shrubs, planted for ornament, and probably selected at the time for their suitability for the district. Amongst them are: *Euonymus europæus* (Spindle tree), *Rhamnus catharticus* (Buckthorn), *Pyrus Aria* (White Beam tree), *P. Aucuparia* (Mountain Ash), *Cornus sanguinea* (Dogwood), *Viburnum Opulus* (Gueldres Rose), *V. Lantana* (Wayfaring tree), and *Berberis vulgaris* (Barberry).

The Rev. E. Maule Cole, M.A., F.G.S., writes: One of the best hunting grounds for flowers is on the railway between Fimber and Wetwang. Here the Ox-eye presents almost the appearance of a wreath of snow. Near the far signal-post, half-a-mile from Wetwang Station, is a colony of lilac-coloured gentian. eyebright, milkwort, field convolvulus, bird's foot and purple trefoil, harebell, cinquefoil, speedwells, hawkweeds, &c., occur in profusion. The blue geranium, is not uncommon; there is also a wax-like pink centaury; likewise a colony of saxifrage on the top of one of the branching dales near Towthorpe, hitherto unrecorded, and green hellebore, wild strawberries, raspberries, and blackberries abound in the words, gorse on the wastes, and dog-roses in the hedges.

Experienced botanists may expect a rich harvest in this locality, though experienced farmers can well spare the 'brassics' which will persist in coming to the fore notwithstanding all the efforts of the school-children. Whenever the ground is ploughed a little deeper than usual, the resinous seeds of this plant burst into fresh life, and cause no end of expense and labour to keep them within bounds. One farmer hit upon the happy expedient of letting well alone (?) and sent the seeds to Hull to be ground into oilcake!

Mosses and Hepatics.—The following species have been gathered by Mr M. B. Slater, F.L.S., in the district:—**Mosses:** *Barbula lævipila, Barbula papillosa, Ulota bruchii, Orthotrichum lyellii, O. pulchellum, Cryphæa heteromalla, Leucodon sciuroides, Thuidium recognitum, Plagiothecium undulatum, P. sylvaticum.* **Hepatics:** *Lophocolea heterophylla, Ptilidium ciliare* var. *pulchrum, Frullania dilatata, Radula complanata.* On trees in the woods and hedge-rows, and in shady places in old chalk quarries are the best places to search for mosses and hepatics at this season. Many of the larger Pleurocarpous mosses, which grow on shady rocks and banks, do not fruit at this season and are best collected in the autumn, say October, and during mild weather through the winter months.

The lists of East Riding Mosses and Hepatics by Dr. Parsons and Spruce in the Union Transactions, parts 2 and 4, should be consulted.

Lichens, Fungi and Algæ have not been worked.

VERTEBRATE ZOOLOGY.—The Rev. E. Maule Cole, M.A., F.G.S., supplies the following:

Mammalia.—Large and Small Bat, Field Shrew, Short-tailed Field Mouse, Common Rat, Water Rat, Weasel, Stoat, Squirrel, Hedgehog, Mole. Hare, Rabbit, Fox, Badger, and Fomard.

Birds.—As no list of birds of the district has yet been given I venture to record in full those which have come under my own observation, though doubtless many varieties of small birds have escaped my notice. The order of names follows the Latin index in Montagu's Ornithological Dictionary:—Sparrow Hawk, Hedge Chanter, Wood Lark, Sky Lark, Meadow Pipit, Barn Owl, Wild Duck, Wren, Goose, Heron. Night Jar, Goldfinch, Creeper, Hen Harrier (1868), Ring Dove, Carrion Crow, Hooded Crow, Rook, Jay, Jackdaw, Magpie, Cuckoo, Whitethroat, Swift, Yellow Hammer, Bunting, Snowfleck (1875), Peregrine Falcon (1888),

Buzzard (1890), Kestrel, Linnet, Greenfinch, Chaffinch, Sparrow, Redpole, Water Hen, Sand Martin, Swallow, Martin, Gull, Crossbill, Bullfinch, Blackbird, Pied Wagtail, Spotted Flycatcher, Curlew, Stone Curlew (1868), Landrail, Horned Owl, Cole Tit, Tom Tit, Bottle Tit, Great Tit, Partridge, Pheasant, Green Woodpecker, Dabchick, Gold Crest, Stonechat, Snipe, Woodcock, Tawny Owl, Starling, Blackcap, Garden Warbler, Redstart, Redbreast, Wood Wren, Lapwing, Redwing, Thrush, Fieldfare, Missel Thrush, Sand Grouse (1888). It may be mentioned with regard to the Dabchick, that having been rescued from the village mere, where it had been nearly pelted to death, it was brought to the Vicarage only to meet with a melancholy end. For a compassionate servant, exclaiming "Puir thing, its a watther bird," held it head downwards in a bucket of water in order to revive it!

Reptiles.—Lizard, Newt, Frog, Toad. **Fish.**—Stickleback.

ENTOMOLOGY.—The Rev. E. Maule Cole, M.A., F.G.S., reports that: There are abundance of Butterflies and Moths, garden whites, large and small, and the Marbled White, which has chosen the high ground (500 feet) for one of its localities, brown fritillaries, and delicate little blues, skippers, red admirals, ringlets, meadow browns and tortoise shells; large white moths flit about like spectres in the darkening twilight, tiger, oak, and hawk moths, vapourers and magpies are fairly plentiful. The colours of little enamelled beetles, scarlet and green, are exquisite. Dragon flies of various hues hover over the artificial ponds, whilst water spiders skim across their surface, and great water-beetles turn up their tails 'to take the air,' and boatmen and whirligigs rush hither and thither. Nests of tree wasps are not uncommon, and I have taken specimens of the sirex, locust (1880), and the large green caterpillar of the Death's-head Moth.

Mr. Edgar R. Waite, F.L.S., adds that while in the district arranging the Excursion on July 4th and 5th he took the following species, among others:—

Coleoptera.—*Silpha* sp.? (and larvæ), *Hister cadaverinus* (both found on dead Hedgehogs), *Pyrochroa coccinea* (common on nettles).

Lepidoptera.—*Pieris rapæ*, *Hipparchia janira*, *Enodia hyperanthus*, *Cœnonympha pamphilus*, *Cynthia cardui*, *Vanessa urticæ* (and larvæ), *Polyommatus alexis* (common), *Hesperia sylvanus*, *Arctia plantaginis*, *Triphœna pronuba* (common), *Asthena blomeri* (common), *Abraxas ulmata*, and *Tanagra chærophyllata*.

Orthoptera.—*Agrion puella* (fairly common), Grasshopper sp. (abundant).

CONCHOLOGY.—The Rev. E. Maule Cole, M.A., states that snails are everywhere, especially in his garden, worse luck! but in great profusion on the railway, and in some quarries. Mr. W. Denison Roebuck, F.L.S., adds that the woods of York Dale, which include plenty of beech, abound in woodland species, such as *Clausilia laminata* and its var. *tumidula*, *Cl. rugosa*, *Helix arbustorum*, *H. nemoralis*, *Zonites fulvus*, *Z. alliarius*, *Z. crystallinus*, *Z. nitidulus*, *Z. radiatulus*, *Helix hispida*, *Vitrina*, &c., all of which have been collected there this year. The chalk pit near the railway (marked on the map) affords abundance of *Helix ericetorum* and *H. virgata*, and a few *H. caperata*. Other woodland species may be looked for, but there being no streams in the district, water shells are absent.

MICRO-ZOOLOGY AND MICRO-BOTANY.—No information for the immediate neighbourhood, but *Volvox* has been found in a pond near Burdale, altitude 400 feet.

AMATEUR PHOTOGRAPHERS will find suitable subjects in the fine trees in Sledmere Park, and attention may be specially directed to the gigantic Silver Fir which stands in front of Sledmere House.

LISTS OF THE FAUNA AND FLORA of the district, which comprises the drainage area of York Dale and its ramifications, as shown on the Map, are in preparation, and therefore it is advisable that all reliable information, fragmentary or otherwise, be supplied at the Sectional Meetings.

PROGRAMME OF MEETINGS.—

4- 0 p.m.—Meat Tea, 2/- each, at the Black Swan Inn, Wetwang.
4-45 p.m.—Sectional Meetings } If fine in Mr. Cole's garden at Wetwang;
5-15 p.m.—General Meeting } otherwise in the Wetwang School Room.
6- 0 p.m.—Train leaves for Driffield and the South.
7- 0 p.m.—Train leaves for Malton and the North and West.

Yorkshire Naturalists' Union.

President:

PROF. A. H. GREEN, M.A., F.R.S., F.G.S., Oxford.

Hon. Secretaries:

WM. DENISON ROEBUCK, F.L.S., Sunny Bank, Leeds.
REV. E. P. KNUBLEY, M.A., Staveley Rectory, Leeds.
EDGAR R. WAITE, F.L.S., Philosophical Hall, Leeds.

THE NINETY-FOURTH MEETING

WILL BE HELD AT

DONCASTER,

FOR THE INVESTIGATION OF

EDLINGTON & WADWORTH WOODS,

CONISBOROUGH,

The DENABY MAIN and CADEBY COLLIERIES, &c.,

On THURSDAY, 17th September, 1891,

AND WILL BE PRECEDED BY A

FUNGUS FORAY,

On WEDNESDAY, 16th September, 1891.

This excursion is planned for two days, of which the principal one will be the second. Members not able to attend both days and able to choose, are requested to attend on the Thursday.

RAILWAY ARRANGEMENTS.—Return tickets at pleasure party fares issued at all Yorkshire stations on the G.N., H. & B., L. & Y., L. & N.W., M.S. & L., Mid., and N.E. Railways, for **MEXBOROUGH** or **DONCASTER** (with permission to break the outward journey at Mexborough or the return journey at Doncaster as the case may be) to Members and Associates producing signed card of Membership. Members wishing to stay the whole excursion may book on Tuesday to return on Friday.

Members and Associates starting from stations which have not through booking arrangements, should book to the most convenient junction, and re-book to their destination; the reduction of fare will be granted for both portions of the journey.

PERMISSION is kindly granted by Earl Fitzwilliam, Mr. F. J. Savile Foljambe, Lady Copley, and the Denaby Main Colliery Company, Limited.

BOOKS and MAPS.—The whole field of Excursion is included in Sheet 87 S.E. One-inch Ordnance Map (also published geologically coloured), and in Sheets 284 and 285 of the Six-inch Map. Geological and botanical reference may be made to Davis and Lees' 'West Yorkshire,' 1878, and to a List of Plants contained in the Salt Herbarium at the Sheffield Museum (copies of which may be had from Mr. E. Howarth, F.R.A.S., the Curator).

ENTOMOLOGY.—The district is very rich in insects and many local species are to be found.

Coleoptera.—Mr. E. G. Bayford considers that diligent search is certain to be well rewarded. Amongst the beetles already recorded for Edlington Wood are *Leistus rufescens*, *L. ferrugineus*, various *Hydropori* and *Coccinellæ*, *Strangalia*, *Œdemera nobilis*, etc.; and on the Don banks between Conisborough and Hexthorpe, *Nebria brevicollis*, *Pterostichus striola*, *Bembidium rufescens*, and two species of *Meloë* have been found.

Lepidoptera.—Messrs. H. H. Corbett, A. E. Hall, and W. E. Brady write that those members who attend both days would do well to 'sugar' on the Wednesday evening, as *Euperia fulvago*, and other good things might be taken. The following imagines may be reasonably expected to be captured during the excursion or at 'sugar':—*Gonepteryx rhamni*, genus *Vanessa*, *Cidaria russata*, *Gortyna flavago*, *Hydræcia nictitans*, *H. micacea*, *Noctua glareosa*, *Anchocelis rufina*, *A. litura*, *Scopelosoma satellitia*, *Xanthia fulvago*, *X. ferruginea*, *Polia chi*, *Hadena protea*, *Agriopis aprilina*, etc. Among larvæ *Abraxas ulmata* should be swarming. *Ephyra omicronaria* might be beaten, and *Acronycta alni* has also been taken. *Notodonta camelina*, *N. dictæoides*, *N. dromedarius*, and *N. ziczac* should be found on aspens in Wadworth Wood.

CONCHOLOGY.—The limestone cliffs about Conisborough and the woodlands of Edlington and Wadworth, etc., will yield their characteristic species in abundance, while aquatic forms will be found numerously in the low-lying country nearer to Doncaster. Altogether, the district will well repay investigation.

VERTEBRATE ZOOLOGY.—Mr. H. H. Corbett, of Doncaster, remarks that such species as haunt woodland are well represented.

Mammalia.—The Noctule, Fox, Dormouse, Squirrel, Hedgehog, Mole, Water-Vole, etc., are noted by Mr. Corbett as occurring.

Birds.—Woodpeckers are common. The Turtle Dove is abundant, but will now probably have gone. Edlington Woods are well known as the resort of the Nightingale. Mr. J. M. Kirk has noted the Pied Flycatcher, Bullfinch, Redstart, and Hooded Crow in the woods and fields by the Don below Conisborough.

Reptiles and **Fishes.**—No memoranda.

MICRO-ZOOLOGY AND MICRO-BOTANY.—Mr. John Howitt mentions that a pond to the north of the house in Edlington Wood is very prolific in Rotifers and Freshwater Algæ.

Mr. J. M. Kirk has found *Melicerta* in Newton pond, also three species of Hydra at one time, viz.:—*H. vulgaris*, *H. viridis*, and *H. fusca* (scarce). Scawthorpe pond has yielded good gatherings of Desmids and Diatoms. The pond at the second railway bridge (from Doncaster) at Bentley is rich in desirable objects, containing amongst many others:—*Stephanoceros*, *Floscularia ornata*, *Melicerta*, *Limnias ceratophylli*, *Vaginicola crystallina*, *Megalotrocha flavicans*, *Carchesium polypinum*, *Stentors*, *Epistylis*, *Actinophrys sol*, *Pterodina*, *Tardigrada*, and sometimes *Volvox globator*. Arksey Pond should receive special attention, as it has not yet been worked microscopically.

AMATEUR SCIENTIFIC PHOTOGRAPHERS will find suitable subjects in the fine district extending along the valley of the Don from Conisborough to Sprotborough. Mr. M. H. Stiles, 2, Frenchgate, Doncaster, will furnish information on this and other matters connected with the meeting.

Dark Rooms for changing plates and also for trial development are available at Doncaster by the kindness of Mr. Walter Roberts, Mr. Geo. Bisat, and others.

PROGRAMME OF THURSDAY'S MEETINGS.—

5- 0 p.m.—Meat Tea, 2/- each
6- 0 p.m.—Sectional Meetings
6-30 p.m.—General Meeting

All at 'The Glyn Hotel,' close to Doncaster Station.

YORKSHIRE NATURALISTS' UNION: 26th ANNUAL REPORT.

In presenting the twenty-sixth annual report the Executive Council have to state that the Union still remains in a flourishing and prosperous condition, with the result that both at its excursions and by the individual researches of its members and associates much good work is being done towards the investigation of the fauna and flora and physical features of the county. It is peculiarly the task of the county Society to undertake work of a character which is beyond the scope of the local Societies which in Yorkshire are so numerous and so active, and that the Union is fully alive to the responsibilities which are thus entailed upon it, is fully evidenced by the publication recently of the handsome and singularly complete volume upon the Flora of West Yorkshire from the pen of Mr. F. Arnold Lees, by the commencement of the issue of a new and revised edition of Mr. J. Gilbert Baker's classical and very scarce work on North Yorkshire, and by the success which has attended the operations of the Yorkshire Boulder Committee and of the sister committee for investigating the Marine Zoology of the Yorkshire Coast.

The Meetings held during the year have been five in number, the places and dates being as follows :—Saltburn-by-the-Sea, Whit-Monday, 30th May ; Gormire Lake and Thirkleby Park, Wednesday, 20th July ; Sedbergh and Howgill Fells, Monday, 1st August ; Welton Vale, Saturday, 27th August ; Hatfield Chace, Wednesday, 21st September. For each of these excursions the usual fully-descriptive circular which conduces so much to the success of the day's investigations was issued, and at all the meetings some good results were achieved. [The detailed description of each meeting is here omitted, full particulars having from time to time appeared in this journal].

On all these occasions the Union has been indebted as of old to the great kindness of the landowners for facilitating research on their estates, and to the Yorkshire Railway Companies for the privileges granted to the members attending the various excursions and meetings.

The Societies which constitute the Union now number 37, being an increase upon the number reported twelve months ago. Two societies—the Beverley and Honley Naturalists' Societies—having ceased to exist, are no longer borne on the roll. On the other hand the addition of the Ackworth School Natural History Society, Brighouse Friends' Botanical Society, Craven Naturalists' Association, Leyburn Literary and Scientific Society, Leeds Y.M.C.A. Naturalists' Club, Scarborough Philosophical Society, and Thirsk

Natural History Society, seven strong societies—is evidence that the active study of natural science in Yorkshire—partly due to the stimulus given by the periodical visits of this Union to the various parts of Yorkshire—is steadily on the increase.

The statistics which the secretaries of the various societies are obliging enough to furnish, as in previous years, show that the number of Associates (that is, of the aggregate membership of the affiliated societies) is now 2,109, which being added to the direct membership makes a sum total of nearly 2,500 members and associates.

The Membership still continues to be a source of anxiety to your Executive Council, inasmuch as it remains stationary at about 375, in spite of the very strong claims which the Union—as the central and county Society—has upon the support of all Yorkshire naturalists.

The Financial Position of the Union continues to be in a sound and healthy condition.

The Local Treasurers continue to be a much-valued help to your Secretaries and Executive, and are of much service to the members who reside in their respective districts.

The Publications of the Union have been as heretofore, with the addition of the long-expected and recently-issued Flora of West Yorkshire.

The Transactions.—Parts 10 and 11 are now ready, and will be distributed in course of a few weeks. The former part contains papers on Yorkshire Botany, and a continuation of the Rev. W. C. Hey's List of Yorkshire Beetles. The latter part is entirely devoted to the first instalment of Mr. Baker's North Yorkshire, illustrated by a remarkably clear and distinct geological map of the North Riding.

The two parts which will succeed those first mentioned are intended to be mainly devoted to continuing this valuable work, which the Union is fortunate in having had placed at its disposal by its distinguished author. The geology, which forms the instalment about to be issued, has been carefully revised to date by Mr. J. Edmund Clark, of York, and the map which accompanies it, is an exceptionally successful and clear one. The chapters on lithology and climatology, which the author has himself revised, are now being printed, and they will be followed by the Flora proper. This is also brought down to date, and includes the observations of later investigators. The chapter on mosses has been confided to Mr. Matthew B. Slater, of Malton, than whom no one is more competent to deal with the subject. Mr. Slater will also add, what was not in the original edition, a list of the North Riding hepatics.

The West Yorkshire Flora has now been issued to the subscribers. It is in every respect a credit to its author and his collaborators, from its remarkable completeness, accuracy and fulness of detail, and handsome appearance. It forms a portly volume of about 850 pages, and is—as Mr. Baker informs us—the most complete work of its kind which has appeared for any district of comparable extent in the world. It will always be to the credit of the Union that it was the means of finally bringing about the production of so useful a work.

The Naturalist has been regularly and punctually published month by month, and has formed a convenient and much-appreciated vehicle for communications relating, not only to Yorkshire, but to the whole of the North of England. All that it needs is such an increase in the number of subscribers as will not only place the balance on the right side of the account, but also provide funds for improving the journal, by enabling its editors to give occasional illustrations.

The Library of the Union has been largely increased during the year, partly by purchase, but mostly by donations from members and friends, including Messrs. S. A. Adamson, W. Eagle Clarke, Rev. Canon Fowler, J. G. Goodchild, J. H. Gurney, jun., J. A. Harvie-Brown, J. E. Harting, Alfred Harker, P. F. Lee, Prof. G. A. Lebour, J. C. Melvill, R. T. Manson, F. Nicholson, E. E. Prince, R. Ridgway, T. Mellard Reade, W. D. Roebuck, R. Spruce, Rev. W. Thompson, etc.

The Union being a subscriber to the Zoological Record—a most important annual publication—availed itself during the year of purchasing, on very advantageous terms, the complete set of back volumes. A similar opportunity of filling up to a large extent the gap which exists in the Union's set of the Zoologist was also made use of. Amongst the other books which have been added are Canon Fowler's new work on British Coleoptera, Mr. Ridgway's on Colour for Naturalists, Mr. Thompson's Florula Sedbergensis, Mr. Mellard Reade's Origin of Mountain Ranges, Prof. Lebour's Geology of Northumberland and Durham, and Harvie-Brown and Buckley's Vertebrate Fauna of Sutherland and Caithness.

The Executive take this opportunity of acknowledging the services of Mr. Chas. Brownridge as Honorary Librarian during the year. Thanks to him, the Library has been put in order, ready for the preparation of the catalogue, a necessary preliminary to members being able to make use of the books.

The books and other property of the Union are stored at the Leeds Mechanics' Institute, through the kindness of its Committee,

to whom the Executive are under great obligation for the use of the Board-room for their meetings.

The Librarian will be pleased at any time to receive from members copies of suitable books, particularly of works written or published by themselves or dealing with Yorkshire natural history or geology.

The Sections of the Union have carried on their work during the year with the energy and success of former years, and their operations have tended much to the success of the various meetings.

Committees of Research.—During the year the two Committees which were appointed at the last annual meeting for specific research have carried on their operations with success.

The Yorkshire Boulder Committee has already scheduled a large number of erratics, and have duly published the results. The value of their work has been borne witness to by the Boulder Committee of the British Association, who state that were similar committees formed in other counties and their operations carried on with the same vigour and success as in Yorkshire, the work of the British Association Committee would soon be brought to a satisfactory conclusion.

The other Committee, that for investigating the Marine Zoology of the Yorkshire Coast, although they have not as yet published their results, have been working quietly at their subject. A goodly number of specimens have been sent in and recorded for the future use of the Committee.

British Association.—The Union has again been selected as one of the associated societies of the British Association, and at the Manchester meeting (which was largely attended by members of this Union) Mr. C. P. Hobkirk, chairman of the Executive, was the official representative at the Conferences of Delegates of Scientific Societies.

Proposed Alteration of the Constitution.—Your Executive have given very careful consideration to the question which a resolution of the last Annual Meeting placed in their hands, and are unanimously of opinion that the present regulations for the election of the General Committee of the Union are calculated to meet all the requirements that can legitimately arise, and that the rules being sufficiently comprehensive and practicable in their present form, do not need amendment.

The Secretariate.—Your Executive have to express their satisfaction that the heavy labour which the work of the Union entails upon its honorary secretaries has been substantially relieved by the appointment at the last annual meeting of Messrs. P. H.

Grimshaw and W. C. Scott as Honorary Assistant Secretaries, each of whom has taken charge of a definite branch of work which would otherwise have fallen as of old upon the Honorary Secretaries.

The Presidency of the Union for 1888 has been offered to and accepted by a well-known Yorkshire geologist, intimately connected with the district in which the present annual meeting is being held, and in Mr. Wilfrid H. Hudleston, M.A., F.R.S., who is one of the Secretaries of the Geological Society of London and an Editor of the Geological Magazine, and whose monographic papers on the palæontology of the Oolitic Rocks of Yorkshire are so well-known, we have a worthy successor in the series of distinguished Yorkshiremen who have for the past ten years presided over the Yorkshire Naturalists' Union.

In conclusion, the Executive have to express a regret, which will be unanimously shared by the members, that Sir Ralph Payne-Gallwey could not honour the Union by accepting the office of President for the customary second year. They have also to express gratification at the success which has, under Sir Ralph's presidency, attended the proceedings of the Union during the past year.

April 1888.

THE YORKSHIRE NATURALISTS' UNION: ANNUAL MEETING AT MALTON.

The Twenty-sixth Annual Meeting, held this year at Malton, on Wednesday, the 7th of March, was an extremely successful and pleasant one—a result for which the exertions of the members of the Malton Society (which enjoys a high place among our local societies) are in the main responsible. By the courtesy of the Committee of the Malton Institute, various rooms in that building were placed at the Union's service. The proceedings commenced at 3.15 p.m., when the General Committee met in the Museum for the transaction of the Union's business. The attendance included the official delegates of seven societies (eleven others being unofficially represented by Permanent Members of the Committee), the two honorary secretaries and one honorary assistant-secretary, the honorary librarian, four presidents and seven secretaries of sections, two other members of the Executive, and twelve other Permanent Members of the General Committee—making a total of forty. The Rev. E. Maule Cole, M.A., a vice-president, occupied the chair. The minutes of the preceding annual meeting were read, discussed, and then unanimously adopted, on the motion of Mr. Erskine Stuart, seconded by Mr. S. A. Adamson.

The Twenty-sixth Annual Report was then read by the secretaries, together with the certificate of the auditors to the effect that the accounts had been duly examined and found to be correct, after which the Reports were adopted, on the motion of Mr. John Stears (Hull), seconded by Mr. Washington Teasdale, F.R.A.S. (Leeds).

The excursion-programme for 1888 was then fixed as follows, on the recommendation of the Executive, unanimously confirmed on the motion of Mr. J. J. Stead (Heckmondwike), seconded by Mr. P. F. Lee (Dewsbury):—

Leyburn; Whit-Monday, 21st May.
Saddleworth; Saturday, 16th June.
Robin Hood's Bay; Monday, 16th July.
Market Weighton, for the Wolds; Bank Holiday Monday, 6th August.
Fungus Foray, with Meetings at Leeds, about the end of September.

It was then decided, on the motion of Mr. W. Denison Roebuck, F.L.S., seconded by Mr. J. W. Addyman, B.A., that for the purpose of arranging excursions in future years, the five districts of the county be Mr. Cottrell Watson's well-known botanical divisions, viz.: South-East York, North-East York, North-West York, Mid-West York, and South-West York. The principal changes involved are the

division of what is now the North-Western Hills district into two districts, and the abolition of the Central district, decided advantage being likely to accrue from the increased facility for visiting the Western dales.

Proceeding to the election of officers, it was first announced that, as stated in the concluding paragraph of the Report, Mr. W. H. Hudleston, M.A., F.R.S., had accepted the presidency. The two retiring Hon. Secretaries (Wm. Denison Roebuck, F.L.S., and Wm. Eagle Clarke, F.L.S., both of Leeds) were re-elected, as were also the two retiring Hon. Assistant Secretaries (Percy H. Grimshaw, Burley-in-Wharfedale, and W. Cecil Scott, Leeds), the retiring Hon. Librarian (Charles Brownridge, F.G.S., Leeds), the ten retiring members of the Executive (S. A. Adamson, F.G.S., Leeds; Wm. Cash, F.G.S., Halifax; J. W. Davis, F.S.A., Halifax; G. C. Dennis, York; John Emmet, F.L.S., Boston Spa; Rev. Wm. Fowler, M.A., Liversedge; Charles P. Hobkirk, F.L.S., Dewsbury; Benjamin Holgate, F.G.S., Leeds; H. T. Soppitt, Bradford; and J. J. Stead, Heckmondwike), and the two retiring Auditors (J. E. Bedford and C. D. Hardcastle, both of Leeds).

The Committees of Research were then appointed.

The Yorkshire Boulder Committee was re-appointed, consisting of Prof. A. H. Green, M.A., F.R.S., Leeds (chairman); C. D. Hardcastle, Leeds (vice-chairman); S. A. Adamson, F.G.S., Leeds (hon. secretary); J. E. Bedford and C. Brownridge, F.G.S., Leeds; S. Chadwick, Malton; Rev. E. Maule Cole, M.A., Wetwang; J. W. Davis, F.G.S., Halifax; W. Gregson, Baldersby; John Hill, Morley; B. Holgate, F.G.S., Leeds; Wm. Horne, F.G.S., Leyburn; Prof. L. C. Miall, F.L.S., Leeds; James Spencer, Halifax; Thos. Tate, F.G.S., Leeds; and J. W. Woodall, F.G.S., Scarborough.

The Yorkshire Marine Zoology Committee was also re-appointed, to consist of the following members:—Dr. H. C. Sorby, F.R.S., Sheffield (chairman); Rev. E. H. Smart, B.A., Kirby-in-Cleveland (hon. secretary); George Brook, F.L.S., Huddersfield; J. Darker Butterell, Beverley; Wm. Cash, F.G.S., Halifax; Wm. Eagle Clarke, F.L.S., Leeds; John Cordeaux, M.B.O.U., Great Cotes; Rev. W. C. Hey, M.A., York; Baker Hudson, M.C.S., Coatham; T. H. Nelson, M.B.O.U., Redcar; O. T. Olsen, F.L.S., Grimsby; and Rev. H. Smith, Redcar; with George Massee, F.R.M.S., Kew, as Botanical Referee.

In addition to these, it was unanimously resolved, on the recommendation of the Executive, and the motion of Mr. W. Cash, F.G.S., that a Committee be appointed for the investigation of the Fossil Flora of the county of York, and that it consist of the following members:—Prof. W. C. Williamson, F.R.S., Manchester

(chairman); W. Cash, F.G.S., Halifax (hon. secretary); S. A. Adamson, F.G.S., Halifax; Thos. Hick, B.A., B.Sc., Manchester; B. Holgate, F.G.S., Leeds; Robert Kidston, F.G.S.; Prof. L. C. Miall, Leeds; James Spencer, Halifax; John Stubbins, F.G.S., Leeds; and William West, F.L.S., Bradford.

It being in the power of the General Committee to add to its own number ten Permanent Members annually, this power was used, Messrs. F. Boyes, Beverley; James Carter, Masham; William Foggitt, Thirsk; Alfred Harker, M.A., F.G.S., Hull and Cambridge University; Wm. Horne, F.G.S., Leyburn; Baker Hudson, M.C.S., Coatham; J. C. I'Anson, F.G.S., Saltburn-by-the-Sea; Rev. Wm. Jessop, F.A.S., Rawdon; T. H. Nelson, M.B.O.U., Redcar; and John Stubbins, F.G.S., F.R.M.S., Leeds.

The unanimous election of Messrs. Robert Barnes, Saltburn-by-the-Sea; Geo. S. Gibb, LL.B., York; the Hon. H. W. Fitzwilliam, M.P., Malton; Zechariah Waite, Whitby; A. W. Walker, Malton; and William Young, M.D., Malton, as members of the Union, followed, all having been duly proposed in writing.

The next business was the selection of the place of the next Annual Meeting, for which invitations were submitted from Sheffield and Halifax—the former town being eventually selected—and the date fixed for Friday, 16th of November next. This concluded the business of the General Committee, which then adjourned.

The sections then met and elected their officers as follows :—

B. Vertebrate Zoology.—Rev. E. Ponsonby Knubley, M.A., M.B.O.U., Rector of Staveley, re-elected president, and Mr. James Backhouse, jun., F.Z.S., M.B.O.U., of York, re-elected secretary, and a second secretary elected in the person of Mr. Thomas Bunker, Goole.

C. Conchology.—Rev. W. C. Hey, M.A., M.C.S., York, re-elected president; Mr. John Emmet, F.L.S., Boston Spa, re-elected secretary, and Mr. Baker Hudson, M.C.S., Coatham, chosen secretary in place of Mr. Butterell, resigned.

D. Entomology.—All the officers re-elected, viz., Mr. N. F. Dobrée, Beverley, president, and Messrs. G. C. Dennis and Samuel Walker, York, secretaries.

E. Botany.—All the officers re-elected, viz., Mr. F. Arnold Lees, L.R.C.P., Leeds, president; Mr. P. F. Lee, Dewsbury, phanerogamic secretary, and Mr. M. B. Slater, Malton, cryptogamic secretary.

F. Geology.—All the officers re-elected, viz., Rev. E. Maule Cole, M.A., Wetwang, president, and Mr. S. A. Adamson, F.G.S., Leeds, and Mr. S. Chadwick, Malton, secretaries.

G. Micro-Zoology and Micro-Botany.—Dr. H. Clifton Sorby, F.R.S., Sheffield, president, and Mr. J. M. Kirk, Doncaster, secretary, both re-elected.

Afterwards tea was served at the Talbot Hotel, and at 7 p.m. the Annual Public Meeting was held in the Theatre of the Malton Institute, when there was a large audience. The chair was taken by the president, Sir Ralph Payne-Gallwey, Bart., M.B.O.U., who, after the annual report and excursion-programme had been read for the benefit of the members generally, delivered the annual address. He took for his subject, 'Yorkshire Decoys and the Method of Decoying Ducks,' illustrating his remarks by a series of lantern-slides. During the delivery of the address the chair was occupied by the Rev. R. W. Elliott, M.A., one of the vice-presidents of the Malton Naturalists' Society. A vote of thanks to the president for his services as such and for his address was cordially voted, on the motion of Mr. John Cordeaux, M.B.O.U., seconded by the Rev. W. C. Hey, in a couple of happily-expressed speeches, and afterwards a similar and well-deserved compliment was paid to the Malton Society for its reception of the Union and to the Rev. R. W. Elliott for presiding, on the motion of the new president, Mr. Wilfrid H. Hudleston, M.A., F.R.S., seconded by the Rev. E. Maule Cole, M.A.

An excellent and most interesting exhibition, which had been arranged by the members of the Malton Society, was open throughout the afternoon and evening, and engaged the attention of the members and associates during the intervals between the various meetings. The objects shown were of a varied character, and were contributed by numerous local gentlemen and ladies, hardly any branch of natural history, art, or antiquities being unrepresented. In addition to this the splendid little museum of the Malton Society was open to inspection.

LIST OF MEMBERS, SEPTEMBER 1888.

The names in black type are those of members of the General Committee.

Abram, J. W., *Foston.*
Adamson, S. A., *F.G.S., Leeds.*
Addison, Rev. Frederick, *M.A., Thirsk.*
Addyman, J. W., *B.A., Starbeck.*
Airy, Rev. Basil R., *Whitwell, York.*
Aldam, William, *J.P., D.L., Frickley.*
Allen, A. H., *F.I.C., F.C.S., Sheffield.*
Anne, Captain E., *J.P., Burghwallis.*
Atkinson, Rev. J. C., *D.C.L., Danby.*
Atkinson, William, *Leeds.*
Backhouse, Jas., *F.L.S., F.G.S., York.*
Backhouse, Jas., jun., *M.B.O.U., York.*
Bairstow, S. D., *F.L.S., Cape Colony.*
Baker, John G., *F.R.S., F.L.S., Kew.*
Barnes, Robert, *Saltburn.*
Barnes-Lawrence, Rev. H. F., *Birkin.*
Barran, John, *M.P., Leeds.*
Barwick, John Marshall, *M.A., Yeadon.*
Beaumont, Alfred, *Lewisham, S.E.*
Bedford, James, *Leeds.*
Bedford, J. E., *F.G.S., Leeds.*
Bennett, Samuel H., *Rotherham.*
Bethell, William, *J.P., D.L., Rise, Hull.*
Bewlay, Frederick, *York.*
Bidwell, E., *M.B.O.U., Twickenham.*
Bilbrough, J. W., *Ben Rhydding.*
Bilbrough, Mrs. J. W., *Ben Rhydding.*
Bingley, Godfrey, *Headingley, Leeds.*
Birchall, Edward, *Leeds.*
Birks, Edward, *Sheffield.*
Birks, Thomas, jun., *Liverpool.*
Blakeley, John Wesley, *Liversedge.*
Boyd, Ven. Archdeacon, *D.D., Arncliffe.*
Booth, James, *F.G.S., Ovenden.*
Booth, Walter William, *Leeds.*
Bothamley, C. H., *F.C.S., Leeds.*
Bould, C. H., *Huddersfield.*
Boyes, Frederick, *Beverley.*
Brady, William E., *Barnsley.*
Braim, John, *Pickering.*
Braithwaite, Wm. D., *Ackworth.*
Branson, F. W., *F.C.S., Leeds.*
Brigg, John, *J.P., F.G.S., Kildwick.*
Brittain, Frederick, *Sheffield.*
Broadhead, John, *Barnsley.*
Broadhead, Seth, *Barnsley.*
Bromley, John H., *Leeds.*
Brook, Geo., ter., *F.L.S., Edinburgh.*
Brooke, Rev. A. St. C. S., *Slingsby.*
Brooke, Edward, *F.G.S., Huddersfield.*
Brooke, John Arthur, *J.P., Fenay Hall.*
Brooke, Rev. Canon J. I., *Thornhill.*
Brooke, T., *J.P., F.S.A., Huddersfield.*
Broughton, C. J. E., *Wortley, Sheffield.*
Brownridge, Charles, *F.G.S., Leeds.*
Brunton, George, *Leeds.*
Bunker, Thomas, *Goole.*
Butterfield, J. A., *Blackheath, S.E.*
Butterfield, E. P. P., *Wilsden.*
Butterell, J. Darker, *Beverley.*
Butterworth, Rev. T. G., *M.A., Leeds.*
Carter, James, *M.B.O.U., Masham.*
Carter, J. W., *Bradford.*
Cash, William, *F.L.S., F.G.S., Halifax.*
Chadwick, S., *Norton, near Malton.*
Chaloner, Rev. J. W., *Newton Kyme.*
Chapman, Abel, *M.B.O.U., Sunderland.*
Chaytor, R. C., *Scrafton Lodge.*
Cheesman, William Norwood, *Selby.*
Clark, J. E., *B.A., B.Sc., F.G.S., York.*
Clark, Robert, *Pickering.*
Clarke, Rev. A., *B.A., Kirkby Malzeard.*
Clarke, W. Eagle, *F.L.S., Edinburgh.*
Clarkson, W. C., *L.R.C.P., Pateley.*
Clayton, John, *Bradford.*
Colby, George, *Malton.*
Cole, Rev. E. Maule, *M.A., Wetwang.*
Colley, Francis H., *Sheffield.*
Conacher, John, jun., *Huddersfield.*
Coning, —, *Malton.*
Copley, Walter, *Sowerby Bridge.*
Cordeaux, John, *M.B.O.U., Ulceby.*
Coupland, Joseph, *High Harrogate.*
Cover, John Lee, *South Milford.*
Craig-Christie, A., *F.L.S., Edinburgh.*
Crawshaw, C. B., *Dewsbury.*
Creyke, Ralph, *J.P., Rawcliffe Hall.*
Crossland, Charles, *Halifax.*
Crossley, William H., *Maltby.*
Crossley, Miss Frances Ann, *Maltby.*
Crossley, Miss Mary A. B., *Maltby.*
Dale, R. Thornton, *Ilkley.*
Dallinger, Rev. W. H., *LL.D., London.*
Darbishire, R. D., *B.A., Manchester.*
Davis, J. W., *F.S.A., F.L.S., Halifax.*
Davison, George, *Beverley.*
Dawson, Oswald, *Leeds.*
Dawson, Percival William, *Hull.*
Denham, Thomas E., *Huddersfield.*
Dennis, George C., *York.*
Denny, Alfred, *Sheffield.*
Devonshire, His Grace the Duke of, *K.G.*
Dickinson, Frederick Wm., *Rotherham.*
Dobree, N. F., *Beverley.*
Dunning, J. W., *M.A., F.L.S., London.*
Eddy, J. R., *F.R.M.S., F.G.S., Skipton.*
Ellis, H. M., *Beverley.*
Emerson, E. B., *J.P., B.A., Redcar.*
Emmet, John, *F.L.S., Boston Spa.*
Emmet, Mrs. John, *Boston Spa.*
Empson, Christopher, *Sowerby Bridge.*
Eskholme, George, *J.P., Rotherham.*
Farrah, John, *Harrogate.*
Faulding, Joseph, *Hastings.*
Featherstone, J. Garbutt, *Brompton.*
Fisher, Rev. Robert, *M.A., Sewerby.*
Fitzgerald, Francis R., *M.C.S., Harrogate.*
Fitzwilliam, Hon. H. W., *M.P., Malton.*
Foggitt, William, *Thirsk.*
Fortune, Riley, *Harrogate.*

Foster, Matthew, *Brough.*
Foster, Charles, *Headingley.*
Fowler, Rev. Wm., *M.A., Liversedge.*
Fox, Rev. H. E., *M.A., Durham.*
Gallwey, Sir Ralph P., Bart., *Thirkleby.*
Gardiner, H. T., *Goole.*
Gardner, J., *Hartlepool.*
Gaunt, Leonard, *Farsley, Leeds.*
Gaunt, Mrs. Leonard, *Farsley, Leeds.*
Gerrard, John, *Wakefield.*
Gibb, Geo. S., *LL.B., York.*
Gill, Hugh, *Boston Spa.*
Gough, Thomas, *B.Sc., F.G.S., York.*
Grant, Thomas, *Pocklington.*
Grassham, John, *Leeds.*
Gray, Thomas H., *Calverley, nr. Leeds.*
Green, Prof. A. H., *M.A., Oxford.*
Greenwood, T. W., *Batley.*
Gregson, William, *Baldersby.*
Grimshaw, P. H., *Burley-in-Wharfedale.*
Grimston, F. A., *Mozergh, Kendal.*
Grove, Edmund, *F.R.M.S., Worthing.*
Gurney, J. H., jun., *F.Z.S., Norwich.*
Haigh, G. H. Caton, *Grainsby.*
Hailstone, Edwd., *F.S.A., Walton.*
Handley, John, *Sedbergh.*
Hardcastle, C. D., *Leeds.*
Harding, Rev. I., *Bradford.*
Harker, A., *M.A., F.G.S., Cambridge.*
Harrison, John, *Wilstrop Hall.*
Harrison, John, *Goole.*
Harvie-Brown, John A., *Dunipace, N.B.*
Herries, Rt. Hon. Lord, *Everingham.*
Hewetson, H. B., *M.R.C.S., Leeds.*
Hewett, William, *York.*
Hey, Rev. Wm. C., *M.A., York.*
Hick, Thos., *B.A., B.Sc., Manchester.*
Hill, Ald. John, *Morley.*
Hindley, A. D., *Liversedge.*
Hirst, Joseph, *Huddersfield.*
Hobkirk, C. P., *F.L.S., Dewsbury.*
Hodgson, William, *Malton.*
Holgate, B., *F.G.S., Hunslet, Leeds.*
Hopkinson, John, *F.L.S., St. Albans.*
Horne, William, *F.G.S., Leyburn.*
Huddart, Rev. G. A. W., *M.A., Ripon.*
Hudleston, W. H., *F.R.S., Weybridge.*
Hudson, Baker, *M.C.S., Redcar.*
Hurst, Josh. S., *Copt Hewick.*
I'Anson, J. C., *F.G.S., F.S.A., Saltburn.*
Ingleby, James, *Eavestone, Ripon.*
Ingram, Hobson, *Horsforth.*
Irvin, Rev. B., *M.A., Saltburn.*
Irvine, Charles Stuart, *Adel, Leeds.*
Jackson, John, *M.P.S., Wetherby.*
Jackson, George, *York.*
Jefferson, R. P., *M.R.C.S., Leeds.*
Jessop, Rev. Wm., *F.A.S., Rawdon.*
Johnson, Henry, *Barnsley.*
Jowitt, Mrs. Hannah, *Ripley, Leeds.*
Kendall, Richard William, *Selby.*
Kidston, R., *F.R.S.E., F.G.S., Stirling.*
King, John, *Headingley, Leeds.*
Kirk, J. M., *Doncaster.*

Knubley, Rev. E. P., *M.A., Staveley.*
Ladmore, E. J., *Bradford.*
Lancaster, William J., *Barnsley.*
Law, A. E., *Sheffield.*
Law, Robert, *F.G.S., Halifax.*
Leach, R. E., *M.A., Beccles, Suffolk.*
Leadman, A. D. H., *F.S.A., Boro'bridge.*
Lee, Phineas F., *Dewsbury.*
Lees, F. Arnold, *M.R.C.S., Leeds.*
Lightfoot, Rev. Geo. H., *Pickering.*
Lister Thomas, *King's Lynn.*
Lloyd, Edward John, *Leeds.*
Loten, Philip W., *Easington, Hull.*
Lund, Charles, *Ilkley.*
Lund, Percy, *Ilkley.*
Lupton, Henry, *F.E.S., Leeds.*
McGhie, William K., *Rastrick.*
Mackie, Rev. John H., *M.A., Sedbergh.*
McIntyre, Joseph Wrightson, *Sheffield.*
McLandsborough, J., *F.G.S., Bradford.*
McLean, Donald, *Golspie, N.B.*
Macpherson, Angus, *Coatham.*
Malt, James, *New Wortley, Leeds.*
Manning, J. B., *Wakefield.*
Marsh, Robert, jun., *Rotherham.*
Marshall. John, *F.G.S., Walsden.*
Mason, P. B., *F.L.S., Burton-on-Trent.*
Massee, G. E., *F.R.M.S., Kew.*
Meade, R. H., *Bradford.*
Meek, J. M., *Coatham.*
Metcalfe, John Henry, *Leyburn.*
Metcalfe, George, *Pateley Bridge.*
Miall, Prof. Louis C., *F.L.S., Leeds.*
Milner, Miss, *Bishopthorpe, York.*
Mitchell, T. Carter, *Topcliffe.*
Moiser, H. R., *F.G.S., York.*
More, A. G., *F.L.S., etc., Dublin.*
Morrison, Walter, *M.P., Malham.*
Naughton, John, *Harrogate.*
Nelson, William, *M.C.S., Leeds.*
Nelson, Thos. H., *M.B.O.U., Redcar.*
Newbitt, Thomas, *Whitby.*
Nuttall, William, *Eccleshill, Bradford.*
Oldfield, G. W., *M.A., Kensington, W.*
Oldroyd, Charles, *Snainton.*
Oldroyd, Edward, *Horbury.*
Ormerod, Thomas, *Brighouse.*
Oliver, Jesse, *Leeds.*
Olsen, O. T., *F.L.S., Grimsby.*
Painter, Rev. W. Hunt, *Congleton.*
Paley, Dr., *Ripon.*
Pallister, John William, *B.A., Leeds.*
Pape, Tom, *Helmsley, York.*
Parkin, George, *Wakefield.*
Parsons, H. F., *M.D., London, S.E.*
Paterson, A., *Doncaster.*
Payne, C. Arthur, *Baldersby.*
Payne, Henry, *M.D., Wath.*
Paver-Crow, R., *J.P., Ornhams Hall.*
Peach, Robert, *Harrogate.*
Pearson, Hugh W., *Malton.*
Pease, H. J. Robinson, *J.P., Beverley.*
Pease, W., *Howden.*
Peirse, Sir H. Beresford, *Bart., Bedale.*

Penistone, Miss F. A., *Leeds.*
Penrith, Right Rev. Bishop of.
Platnauer, H. M., *A.R.S.M., York.*
Pocklington, Henry, *F.R.M.S., Leeds.*
Pocklington, C., *F.R.M.S., Manningham.*
Pollard, Harry, *New Wortley, Leeds.*
Porritt, G. T., *F.L.S., Huddersfield.*
Powell, Francis Sharp, *J.P., Bradford.*
Powell, Rev. Thomas, *Healey.*
Powys, Rev. Annesley, *Meanwood.*
Priestman, Frederick, *J.P., Bradford.*
Prodham, Herbert, *Allerston.*
Proudlock, John, *Market Weighton.*
Pulleine, Mrs. A. C., *Clifton Castle.*
Pyman, W. H. S., *Whitby.*
Radcliffe, Sir P., Bart., *Rudding Park.*
Raven, Rev. T. Milville, *M.A., Bedale.*
Rawson, F. G. S., *Thorpe, Halifax.*
Reynolds, Richard, *F.C.S., Leeds.*
Richardson, Hugh, *Newcastle-on-Tyne.*
Ridgway, J. A., *F.R.A.S., Beverley.*
Ripon, Most Hon. Marquis of, *K.G.*
Roberts, George. *M.C.S., Lofthouse.*
Robinson, William, *Sedbergh.*
Roebuck, W. Denison, *F.L.S., Leeds.*
Rollit, Sir A. K., *LL.D., D.C.L., Hull.*
Rookledge, J., *F.R.M.S., Easingwold.*
Roper, Wm. Greaves, *Sheffield.*
Ross, L. B., *F.C.S., F.R.H.S., Driffield.*
Roundell, Charles S., *London.*
Rowley, Walter, *M.E., F.G.S., Leeds.*
Rowntree, Frank, *London.*
Rowntree, James H.. *Scarborough.*
Russell, W. B., *LL.B., New Leeds.*
St. Paul, Major, *Ripon.*
Salter, John H., *Kidderminster.*
Sawdon, Frederick John, *M.D., Hull.*
Saynor, Benjamin, *Leeds.*
Scargill, A., *Sheffield.*
Scott, Walter Cecil, *Headingley, Leeds.*
Scrope, S. T., *J.P., D.L., Danby.*
Shepherd, C. W., *Ilkley.*
Shuffrey, Rev. W. A., *M.A., Arncliffe.*
Siddell, George, *Sheffield.*
Silabon, George, *Hull.*
Sims, Henry, *Ripon.*
Slater, Rev. H. H., *Irchester, Northants.*
Slater, Matthew B., *Malton.*
Smart, Rev. E. H., *Kirkby-in-Cleveland.*
Smith, Christopher W., *Harome.*
Smith, Rev. Henry, *Redcar.*
Smith, Rev. C., Fullerton, *Lund, Preston.*
Somerset, Herbert, *Doncaster.*
Soppitt, Henry Thomas, *Bradford.*
Sorby, H. C., *LL.D., F.R.S., Sheffield.*
Speight, Harry, *Bradford.*
Spencer, James, *Halifax.*
Spiking, J. F. T., *Birstal.*
Spurling, John, *Wakefield.*
Standen, Robert, *M.C.S., Manchester.*
Stead, John James, *Heckmondwike.*
Stears, John, *Hull.*
Steel, R. Elliott, *M.A., Bradford.*
Stiles, M. H., *Doncaster.*
Stoks, Edwin, *Rawdon, near Leeds.*
Stott, Walter Henry, *Doncaster.*
Stuart, J. A. E., *L.R.C.S.Ed., Staincliffe.*
Stubbins, J., *F.G.S., F.R.M.S., Leeds.*
Summerfield, Rev. R. A., *N. Stainley.*
Swailes, Johnson C., *Beverley.*
Sykes, J., *M.D., J.P., F.S.A., Doncaster.*
Tate, Thomas, *F.G.S., Leeds.*
Taylor, W. W., *Newnham, Cambridge.*
Taylor, John W., *F.L.S., Horsforth, Leeds.*
Taylor, Rev. R. V., *B.A., Melbecks.*
Taylor, Vincent, *B.A., Ilkley, Leeds.*
Teasdale, W., *F.R.M.S., Leeds.*
Terry, James, *Bradford.*
Tetley, C. F., *Headingley, Leeds.*
Tew, T. W., *J.P., Pontefract.*
Thirkettle, George, *Headingley.*
Thompson, Richard, *York.*
Thompson, Major B. Blaydes, *Harrogate.*
Thompson, Rev. W., *M.A., Sedbergh.*
Thrippleton, John, *Leeds.*
Tindall, George, *Newmarket.*
Tindall, Edward, *Knapton Hall.*
Travis, Rev. William Travis, *Ripley.*
Trickett, John, *Dacre Banks, Leeds.*
Waite, Edgar R., *Headingley, Leeds.*
Waite, William, *Clayton West.*
Waite, Zechariah, *Whitby.*
Wake, C. Staniland, *M.A.I., Welton.*
Walker, Samuel, *York.*
Walker, A. W., *Malton.*
Walker, Miss Gertrude, *Thornhill Lees.*
Walker, Isaac, *Rotherham.*
Walsingham, Rt. Hon. Lord, *M.A.*
Walton, F. F., *L.R.C.P., Hull.*
Ward, Henry Snowdon, *Bradford.*
Ward, Seth, *Dewsbury.*
Ward, George, *F.I.C., F.C.S., Leeds.*
Ward, Thos. F., *Middlesbrough.*
Watson, Arnold Thomas, *Sheffield.*
Watson, J. W., *Coatham.*
Watts, Rev. A., *F.G.S., Durham.*
Weetman, Henry, *F.Z.S., Sheffield.*
West, William, *F.L.S., Bradford.*
Wharncliffe, Rt. Hon. Earl of.
Whincup, Richard, *Pateley Bridge.*
Whitaker, T. S., *F.R.G.S., Brough.*
Whitaker, J., *F.Z.S., Rainworth.*
Whitfield, J., *F.C.S., Scarborough.*
Whitwell, William, *London.*
Williamson, Prof. W. C., *Manchester.*
Wilson, John, *J.P., Seacroft Hall.*
Wilson, John H., *Harrogate.*
Wilson, J. E.. *Bradford.*
Wilson, J. Mitchell, *M.D., Doncaster.*
Winter, George, *Doncaster.*
Wood, J., *B.A., F.R.A.S., Boston Spa.*
Woodall, J. W., *M.A., F.G.S., Scarbro.'*
Woodd, Basil T., *J.P., Knaresborough.*
Woodd, C. H. L., *J.P., Oughtershaw.*
Wrigglesworth, E. B., *Wakefield.*
Wright, John, *Terrington, near York.*
Yewdall, Edwin, *Leeds.*
Young, William, *M.D., Malton.*

ANNUAL REPORT FOR 1888

(NOVEMBER 1888),

AND

LIST OF MEMBERS,

30th MARCH, 1889.

YORKSHIRE NATURALISTS' UNION.

27th ANNUAL REPORT,

As presented at the Annual Meeting at Sheffield, Nov. 16th, 1888.

THE 27th Annual Report (and Balance Sheet) now presented is to be regarded as merely an interim one, inasmuch as it is for a period of eight months only, during the greater part of which—brief as it is—the Union has been deprived of the services of both its honorary secretaries from unforseen causes. Mr. Eagle Clarke was appointed to an important position in the National Museum of Science and Art at Edinburgh, an appointment which necessitated his removal to that city at the end of May; while a month later, his colleague, Mr. Denison Roebuck, was totally disabled from all work for nearly four months by a very serious and unfortunate accident. Nevertheless, the work of the Union was taken up and carried on with the customary vigour and success, thanks to the prompt kindness of various members resident in Leeds. Particular credit is due to Mr. S. A. Adamson for assuming the duties of the honorary secretaryship at a critical time, and for the valuable services which entitle him to the gratitude, not only of the Executive, but of the members in general. Similar credit is due to Mr. F. Arnold Lees, who in like manner rendered invaluable assistance in the Editorial conduct of *The Naturalist*. The Executive therefore feel pleased to be able to report that at the present time the Union and its affairs are on the whole in a satisfactory and flourishing condition.

The Meetings which have been held during the year have been five in number, one in each division of the county. The places and dates have been as follows:—

Leyburn Shawl, Whit-Monday, 21st May.
Saddleworth, Saturday, 16th June.
Robin Hood's Bay, Monday, 16th July.
Market Weighton, Bank Holiday Monday, 6th August.
Fungus Foray at Bramham and Harewood Parks, Tuesday, 25th Sept.

For each of these meetings the usual fully descriptive circular, which is so conducive to the convenience of members undertaking the day's investigations, was published, and at all the meetings—with one notable exception, caused by adverse meteorological conditions—good results were achieved.

The opening excursion, arranged for Whit-Monday, at Leyburn, was well attended, the day's work being directed to the exploration of that portion of the northern escarpment of Wensleydale which

extends from Bolton Castle to Leyburn Shawl, and the meeting—over which Prof. A. H. Green, now of Oxford, presided—being held at Leyburn town.

The second meeting was held in June, in the Saddleworth district—one which lies on the western or Lancashire slope of the Pennine range of hills. There was a good attendance, and although the district is not a very productive one in zoölogy or botany, the geologists were able to profit largely by their investigations. At this meeting the chair was occupied by an old and valued friend and ex-president, Prof. W. C. Williamson, and the Union had an opportunity of mingling with a number of well-known and able naturalists from the neighbouring towns of Lancashire.

The third excursion was planned for visiting the Peak and the southern part of Robin Hood's Bay, on Monday, the 16th July, and our President journeyed from London to undertake the leadership of the geological party over ground which he has made peculiarly his own, and whose geology is so largely elucidated by his own researches and papers. Unfortunately, the weather was so thoroughly adverse, rain falling incessantly throughout the day and dense sea-fogs obscuring the view of the coast sections, that nothing whatever could be done, and a speedy retreat was made to the meeting-place at Scarborough by the adventurous score of members who had made the journey. Under these circumstances your Executive feel that the excursion should be again placed on the programme, and they are pleased to know that Mr. Hudleston has most kindly consented again to act as leader.

The fourth meeting was held on the Bank Holiday Monday in August, under better climatic auspices, and with a consequently better scientific result. The meeting was held at Market Weighton, and the day's explorations were directed to the neighbouring portion of the Wold country, lying about Goodmanham and Londesborough.

The concluding meeting of the season was devoted to the Fungus Foray, which our mycological botanists have looked forward to for some years. The date was fixed for the last week in September, and an old and valued member of the Union, Mr. George Massee, F.R.M.S., of Kew, attended as guide and botanical referee. Thanks to his assistance and to that of Mr. Soppitt and other of our botanists, to the suitability of the weather, and to the excellence and varied nature of the collecting-ground in the fine parks and woods at Bramham and Harewood, the Foray was a most decided success, resulting in substantial additions to our knowledge of the Fungus Flora of the county, and it was also the means of adding a couple of species to the British fungus-flora.

On all these occasions the Union has been indebted to the kindness which the landowners of Yorkshire have always been so ready to manifest in facilitating research on their estates; and the facilities which the various railway companies which run on Yorkshire soil have granted, have contributed their share to promoting the success of the Union's investigations.

The Societies which constitute the Union now number 38, the withdrawal of three Societies which are no longer connected with it—the Brighouse Friends' Botanical Society, the Hull Great Thornton Street Wesleyan Field Naturalists' Society, and the Driffield Literary and Scientific Society—being counter-balanced by the accession of other three—the Ellesmere School (Harrogate) Natural History Society, the Hull Scientific Club, and the Hull Geological Society.

The statistics which the Secretaries of the different societies are kind enough to furnish remain as stated in the last annual report, as at 2,109 associates and 375 members—altogether nearly 2,500—the time not having arrived for sending out the schedules on which such information is given.

The Membership of the Union still continues about stationary, and the necessity of a large increase in it will form a subject for the direct attention of the next Executive, additional support being necessary to enable the Union to carry out the investigations which fall to its lot.

The Financial Position of the Union has suffered considerably from the disablement of the Secretarial staff of which mention was made at the beginning of this report. At the time of Mr. Roebuck's accident the receipt-books usually in the hands of the Local Treasurers had all been called in, and he, as General Treasurer, was on the point of re-issuing them to the gentlemen who as Local Treasurers have been of so much service to the Union. On this account the subscriptions could not be collected by them, and consequently the balance-sheet now submitted shows only about half the amount of receipts that would appear in the balance-sheet of an ordinary year. Attention will, of course, be specially given by your Treasurer and Executive during the next few months to the collection of outstanding subscriptions, and it is to be hoped that the members will co-operate in this endeavour.

In connection with this subject your Executive recommend that members possessing a banking account should instruct their bankers to pay their subscriptions annually to the bankers of the Union (Messrs. Wm. Wms. Brown & Co., Leeds). For this purpose the Union Treasurer will be pleased to provide a form of authorization.

The Publications of the Union have been as heretofore.

The Transactions.—Part 12 is all printed, and awaiting binding-up only. It consists entirely of the second instalment of Mr. Baker's 'North Yorkshire,' including two coloured maps of the lithology and climatology of the Riding.

The Library of the Union continues to increase, by numerous donations and exchanges, and stands urgently in need of increased accommodation. Mr. Charles Brownridge, the honorary librarian, to whom the Union is under much obligation for the care and attention he has devoted to his department, reports that there is urgent need of a new bookcase, the books having long overflowed the accommodation provided, and the want of space hampered the whole administration of library matters, and he hopes that the Union may be able before long to provide the necessary accommodation. The books and bookcases are kept in a room at the Leeds Mechanics' Institution, to the committee of which the Executive are also under great obligation for the use of the board-room for their meetings.

The Librarian will be pleased to receive donations, particularly of works or papers dealing with Yorkshire natural history or geology, or memoirs written by Yorkshire scientific writers.

The Sections of the Union have carefully carried on their work during the year, and it is to their efficient working that the success attending the excursions has been due.

Committees of Research.—During the year the Yorkshire Boulder Committee has done a large amount of valuable work, as shown by their report published in the November number of *The Naturalist*, and the value and importance of their investigations has been thoroughly appreciated by the Erratic Blocks Committee of the British Association, in connection with which the Yorkshire work is carried on.

The Marine Zoology Committee's work has been at a standstill, on account of the removal from the county of Mr. Eagle Clarke, who was its secretary.

The Fossil Flora Committee has collected a series of fossil plants from Gristhorpe Bay near Scarborough, and a number of specimens from the Halifax Coal Measures. The fossils containing structure will be submitted for determination to Prof. Williamson, F.R.S., and the remaining ones to Mr. Robert Kidston, F.G.S., of Stirling. The Committee would be glad if such members as can do so, would forward specimens of fossil plants to Mr. Wm. Cash, of 38, Elmfield Terrace, Halifax, the secretary to the Committee.

There are other branches of investigation marked out by the British Association, which it is desirable should be undertaken by

committees of this Union, whenever members are to be found able and willing to act thereupon.

Proposals will be brought forward at this present meeting for the appointment of a committee to deal with the erosion of sea-coasts, this county being particularly suited for research in this direction.

British Association.—The Union has again been selected as one of the Corresponding Societies of the Association, and was represented this year at the Bath meeting by the Rev. E. P. Knubley, M.A., whose report has been published in *The Naturalist.*

Your Executive is pleased to know that the Association has accepted an invitation to meet in Yorkshire two years hence, at Leeds, and it is to be hoped that members will do what lies in their power to render that meeting a successful one.

The International Geological Congress, which has held its meetings this year in England, selected Yorkshire as the scene of two of the excursions, one being in the Craven district and the other on the Coast. These were attended by some of the foreign geologists then in England, and at both excursions this Union was represented by several of its members.

The Secretariate.—Your Executive cannot let this report pass without referring to the very serious loss the Union sustains this day by the retirement of Mr. W. Eagle Clarke from the position as honorary secretary which he has occupied with so much advantage to the Union during the past eight years, nor without an expression of the very sincere and deep regret which all the members and associates must feel at the severance of a connection so long and so intimate as that which has existed between Mr. Clarke and his Yorkshire colleagues.

The Presidency.—In conclusion, your Executive have to announce that the office of President has been accepted by an Ornithologist of the first rank, Mr. Henry Eeles Dresser, who is a Yorkshireman by birth, and the author of what is *the* standard work on European birds, and of numerous papers on the subject of which he is an acknowledged master.

The Executive have further to express their deep sense of the honour which our retiring President, Mr. Hudleston, has conferred upon the Union by his brief tenure of an office, the high character of which has been amply maintained in his keeping.

THE YORKSHIRE NATURALISTS' UNION.

ANNUAL MEETING AT SHEFFIELD.

The 27th Annual Meeting, held at Sheffield on Friday, the 16th November, was as successful as any of its predecessors, and the Union are much indebted to the Sheffield Naturalists' Club for the very excellent arrangements which they had made. Through their instrumentality and that of an old and valued friend and ex-president of the Union, Dr. H. C. Sorby, F.R.S., the Sheffield Corporation had placed the use of the Public Museum and Mappin Art Galleries at the disposal of the Union for the various meetings, and the convenience of members was met by tea being served in the same buildings.

The proceedings commenced at 3 p.m., when the General Committee met in the Art Gallery for the dispatch of business. The attendance included the official delegates of eleven societies (eight others being unofficially represented by permanent members of the Committee), the president and two ex-presidents, the two honorary secretaries, the chairman and four other members of the Executive, three presidents and four secretaries of sections, one of the auditors, two of the honorary local treasurers, and seven other permanent members of the Committee—making a total attendance of forty-five. The chair was occupied by the president, Mr. Wilfrid H. Hudleston, M.A., F.R.S. The minutes of the previous annual meeting were read and unanimously adopted.

The 27th Annual Report (as printed at p. 7 of this number) was read by Mr. Chas. P. Hobkirk, F.L.S., the chairman of the Executive Committee, and upon his motion, seconded by Mr. M. B. Slater, unanimously adopted without discussion.

The Excursion-programme for 1889 was then fixed as follows, upon the recommendation of the Executive, adopted unanimously on the motion of Messrs. J. W. Davis, F.S.A., and J. W. Addyman, B.A., and with the understanding that the selection of dates be left to the new Executive, inasmuch as the date for the coast excursion depended upon the tide-tables:—

Upper Teesdale: a three-days' excursion in August.	Kirkham Abbey and Acklam Brow.
Robin Hood's Bay.	Harrogate.
	Huddersfield.

For the next Annual Meeting, a cordially written invitation from the presidents of the Hull Literary and Philosophical, Field Naturalists', and Geological Societies, for the Union to visit Hull, was read, and accepted by an unanimous vote proposed by the Revs. Wm. Fowler, M.A., and E. Maule Cole, M.A.

Proceeding to the election of officers, it was announced—as stated in the concluding paragraph of the Annual Report—that the Presidency had been accepted by the distinguished author of 'The Birds of Europe and the Western Palæarctic Region,' Mr. Henry Eeles Dresser, F.L.S., F.Z.S. Mr. W. Eagle Clarke, F.L.S., who is retiring from the office of honorary secretary, proposed the re-election of his colleague, Mr. Wm. Denison Roebuck, F.L.S., and the election as his own successor, of the Rev. E. Ponsonby Knubley, M.A., M.B.O.U. This was seconded by Mr. J. J. Stead, and adopted unanimously. Mr. P. H. Grimshaw, Leeds, was re-elected, and Mr. Edgar R. Waite, Leeds, elected, hon. assistant secretaries; Mr. Chas. Brownridge, F.G.S., Leeds, re-elected honorary librarian; as were also nine retiring members of the Executive—Rev. W. Fowler, M.A., Liversedge; Messrs. S. A. Adamson, F.G.S., Leeds; J. W. Davis, F.S.A., Halifax; Wm. Cash, F.L.S., Halifax; C. P. Hobkirk, F.L.S., Dewsbury; John Emmet, F.L.S., Boston Spa; Benjamin Holgate, F.G.S., Leeds; H. T. Soppitt, Bradford, and J. J. Stead, Heckmondwike, with the addition of a tenth member in Mr. M. B. Slater, Malton, in place of Mr. Dennis, retiring. The two retiring auditors—Messrs. J. E. Bedford, F.G.S., and C. D. Hardcastle, both of Leeds, were also re-elected.

Twenty-three local treasurers—Messrs. W. E. Brady, Barnsley; J. D. Butterell, Beverley; H. Speight, Bradford; P. F. Lee, Dewsbury; Geo. Winter, Doncaster; Rev. E. Maule Cole, M.A., Driffield; Messrs. Thos. Bunker, Goole; Wm. Cash, F.L.S., Halifax; F. R. Fitzgerald, Harrogate; J. R. Dore, Huddersfield; E. R. Waite, Leeds; M. B. Slater, Malton; T. F. Ward, Middlesbrough; T. H. Nelson, Redcar; Rev. R. A. Summerfield, Ripon; Messrs. J. H. Rowntree, Scarborough; W. N. Cheesman, Selby; A. T. Watson, Sheffield; J. J. Stead, Spen Valley; W. Gregson, Thirsk; Geo. Parkin, Wakefield; Thos. Newbitt, Whitby, and G. C. Dennis, York—were chosen.

The Committees of Research were then appointed.

The Yorkshire Boulder Committee was re-appointed, to consist of Prof. A. H. Green, M.A., F.R.S., Leeds (chairman); C. D. Hardcastle, Leeds (vice-chairman); S. A. Adamson, F.G.S., 52, Wellclose Terrace, Leeds (hon. secretary); Messrs. J. E. Bedford, F.G.S., and C. Brownridge, F.G.S., Leeds; S. Chadwick, Malton; Rev. E. Maule Cole, M.A., Wetwang; J. W. Davis, F.S.A., F.G.S., Halifax; Wm. Gregson, Baldersby; Ald. John Hill, Morley; B. Holgate, F.G.S., Leeds; Wm. Horne, F.G.S., Leyburn; Prof. L. C. Miall, F.L.S., F.G.S., Leeds; James Spencer, Halifax; T. Tate, F.G.S., Leeds; and J. W. Woodall, F.G.S., Scarborough; with Rev. H. W. Crosskey, LL.D., F.G.S., Birmingham, as Corresponding Member.

The Yorkshire Marine Zoology Committee was also re-appointed, to consist of the following members:—Dr. H. C. Sorby, LL.D., F.R.S., Sheffield (chairman); Rev. E. H. Smart, B.A., Kirby-in-Cleveland (hon. secretary); Messrs. Geo. Brook, F.L.S., Edinburgh; J. D. Butterell, Beverley; W. Eagle Clarke, F.L.S., Edinburgh; John Cordeaux, M.B.O.U., Great Cotes; Wm. Cash, F.G.S., Halifax; Rev. W. C. Hey, M.A., York; Baker Hudson, M.C.S., Redcar; T. H. Nelson, M.B.O.U., Redcar; O. T. Olsen, F.L.S., Grimsby; Rev. Henry Smith, M.A., Redcar; and J. W. Woodall, F.G.S., Scarborough; with Geo. Massee, F.R.M.S., Kew, as Botanical Referee.

The Yorkshire Fossil Flora Committee was also re-appointed, consisting of Prof. W. C. Williamson, LL.D., F.R.S., Manchester (chairman); James W. Davis, F.L.S., F.G.S., F.S.A., Halifax (vice-chairman); William Cash, F.G.S., F.L.S., F.R.M.S., 38, Elmfield Terrace, Halifax (hon. secretary); Messrs. S. A. Adamson, F.G.S., Leeds; Thomas Hick, B.A., B.Sc., Manchester; B. Holgate, F.G.S., Leeds; Robert Kidston, F.G.S., F.R.S.E., Stirling; Robert Law, F.G.S., Halifax; Prof. L. C. Miall, F.L.S., F.G.S., Leeds; James Spencer, Halifax; John Stubbins, F.G.S., F.R.M.S., Leeds; and William West, F.L.S., Bradford.

A new Committee was then appointed, on the motion of the Rev. E. P. Knubley, M.A., seconded by Mr. J. W. Davis, F.S.A, to deal with the Erosion of the Yorkshire Coast, and to consist of Mr. J. W. Woodall, F.G.S., as chairman, and the Rev. E. Maule Cole, M.A., as honorary secretary, and to have power until the next annual meeting to add to their number.

It being in the power of the General Committee to add to its own number ten Permanent Members annually, this power was exercised in favour of Messrs. Edward Birks, Sheffield; J. W. Carter, Bradford; H. Bendelack Hewetson, M.R.C.S., Leeds; Robert Kidston, F.G.S., F.R.S.E., Stirling; A. D. H. Leadman, F.S.A., Boroughbridge; John McLandsborough, F.G.S., F.R.A.S., Bradford; Prof. Louis C. Miall, F.L.S., F.G.S., Leeds; Edgar R. Waite, Leeds; F. Fielder Walton, F.G.S., Hull; and J. W. Woodall, M.A., F.G.S., Scarborough.

The unanimous election, as members of the Union, of the Rev. W. H. Oxley, Filey; Messrs. Elijah Howarth, F.R.A.S., Sheffield; Geo. R. Vine, Sheffield; Rev. W. E. Hancock, Knaresborough; Messrs. E. G. Bayford, West Melton; Benj. Turner, Barnsley; Brooke Rowley, Halifax; F. Whiteley, Halifax; J. E. Jones, Halifax; Dr. Drury, Halifax; and Rev. Chas. Crawshaw, Shipley—all of whom had been duly proposed and seconded, followed, after which

the Pocklington Literary and Philosophical Society was duly admitted into the Union.

Dr. Sorby then took advantage of the occasion of Mr. Clarke's retirement from the honorary secretaryship to move a hearty vote of thanks to the two honorary secretaries for their services, which was seconded by Mr. M. H. Stiles, and unanimously adopted.

Mr. J. W. Addyman then moved a resolution in favour of a change in the constitution of the Union, which was seconded by Mr. Branson, and gave rise to a brief discussion. Eventually the motion, on being put to the vote, was lost, and the meeting was brought to a close.

The sections then met and elected their officers as follows :—

B. Vertebrate Zoology.—Mr. Thos. Bunker, Goole, president; Mr. James Backhouse, jun., F.Z.S., M.B.O.U., York (re-elected), and Mr. Edgar R. Waite, Leeds, secretaries.

C. Conchology.—Rev. W. C. Hey, M.A., York, president; and Messrs. John Emmet, F.L.S., Boston Spa, and Baker Hudson, M.C.S., Coatham, secretaries—all re-elected.

D. Entomology.—Mr. N. F. Dobrée, Beverley, re-elected president; and Messrs. W. E. Brady, Barnsley, and J. H. Rowntree, Scarborough, elected secretaries, in place of Messrs. Dennis and Walker, resigned.

E. Botany.—Mr. Chas. P. Hobkirk, F.L.S., Dewsbury, elected President, and Messrs. P. F. Lee, Dewsbury, and M. B. Slater, Malton, re-elected Secretaries.

F. Geology.—All the officers re-elected, namely—Rev. E. Maule Cole, M.A., Wetwang, president; Messrs. S. A. Adamson, F.G.S., Leeds, and Samuel Chadwick, Malton, secretaries.

G. Micro-Zoology and Botany.—Both officers re-elected, viz., Mr. H. Clifton Sorby, LL.D., F.R.S., Sheffield, president; Mr. J. M. Kirk, Doncaster, secretary.

Tea was then served in one of the rooms of the Art Gallery, and at 7 p.m. the Annual Public Meeting was held in the principal hall of the Art Galleries. There was a large attendance. The chair was taken by the president, Mr. Wilfrid H. Hudleston, M.A., F.R.S. The annual report having been read for the benefit of the members generally by the Rev. E. P. Knubley, M.A., the new secretary of the Union, the presentation of a testimonial to Mr. W. Eagle Clarke, F.L.S., on the occasion of his retirement from the honorary secretaryship, took place. It consisted of an illuminated address, a series of the earlier volumes of 'The Ibis,' and a timepiece. The wording of the address was as follows :—

To Wm. Eagle Clarke, Fellow of the Linnean Society of London, Member of the British Ornithologists' Union and of the British Association Committee on the Migration of Birds, etc.

Sir,—Upon the occasion of your leaving Yorkshire in order to take up an important position in the Museum of Science and Art at Edinburgh, we desire, on behalf of members of the Yorkshire Naturalists' Union and other friends, to express the sincere and deep regret which is felt at your removal from the county, and to offer you some permanent memento of their respect for your personal character, and of their high appreciation of your scientific ability. In your capacity as one of the honorary secretaries of our Union and an editor of its journal *The Naturalist*, as well as by your share in the authorship of the 'Vertebrate Fauna of Yorkshire,' you have not only manifested considerable ability as an ornithologist, but have contributed materially to the advancement of science in Yorkshire. We therefore beg your acceptance of the accompanying volumes of 'The Ibis,' together with a timepiece, as a small token of the esteem in which you are held by friends and fellow-workers, and in grateful recognition of the value of the services which you have so long rendered in promoting the detailed and systematic investigation of the natural history of your native county of York.

Then follow the signatures of the Rev. William Fowler, M.A.; H. Clifton Sorby, LL.D., F.R.S.; Prof. W. C. Williamson, LL.D., F.R.S.; J. Gilbert Baker, F.R.S., F.L.S.; Lord Walsingham, M.A., F.R.S.; Rev. W. H. Dallinger, LL.D., F.R.S.; Sir Ralph Payne-Gallwey, Bart., M.B.O.U.; Wilfrid H. Hudleston, M.A., F.R.S.—all ex-presidents of the Union; W. Denison Roebuck, F.L.S. (Mr. Clarke's colleague in the honorary secretaryship); Charles P. Hobkirk, F.L.S. (chairman of the Union's Executive), and John J. Stead (hon. treasurer to the Testimonial Fund), on behalf of the very numerous subscribers.

The presentation was made by Mr. Hobkirk, who, in a few graceful sentences, gave expression to the mingled feelings of regret at Mr. Clarke's removal to Scotland, and of congratulation to him on the recognition of his scientific abilities shown by his appointment to an important Government post, so generally felt by the members.

The President, Mr. Hudleston, then delivered the address, in which he dealt with 'The Geological History of Iron Ores,' illustrated by a number of large diagrams. Dr. Sorby occupied the chair during the delivery of the address, and at its conclusion proposed a vote of thanks to the President. This was seconded by the Rev. E. Maule Cole, M.A., and unanimously adopted, as was also a cordial vote of thanks to the Sheffield Corporation for the use of the Museum and Art Galleries, and to the Sheffield Naturalists' Club for their kind and hospitable reception of the Union. The remainder of the evening was devoted to the Annual Conversazione of the Sheffield Naturalists' Club, forming a pleasant means of inter-association between the local members and those from a greater distance.

LIST OF MEMBERS AND SOCIETIES.

CORRECTED TO MARCH 30th, 1889.

(The Members whose names are printed in heavy type are those of Permanent Members of the General Committee. The Dates preceding names are those of election; Original Members, being those elected previous to 1883, are marked —).

1888 Abram, J. W., *Foston, viâ Hull.*
1887 Ackworth School Natural History Society.
— **Adamson, Samuel A.**, *F.G.S.*, 52, *Wellclose Terrace, Leeds.*
— Addison, *Rev.* Frederick, *M.A., Sutton Road, Thirsk.*
1886 Addyman, James W., *B.A.Lond., Belmont House, Starbeck.*
1885 Airy, *Rev.* Basil Reginald, *M.A., Whitwell Vicarage, viâ York.*
1883 Aldam, William, *J.P., D.L., etc., Frickley Hall, near Doncaster.*
1886 Anne, Captain E., *J.P., Burghwallis Hall, near Doncaster.*
1883 Atkinson, *Rev. Canon* J. C., *B.A., Hon. D.C.L.Durh., Danby Parsonage, Grosmont, viâ York.*
— Atkinson, William, *Birmingham House, Holbeck, Leeds.*
— **Backhouse, James**, *F.L.S., F.G.S., M.A.I., West Bank, Holgate, York.*
1883 **Backhouse, James, jun.**, *F.Z.S., M.B.O.U., West Bank, Holgate, York.*
— **Bairstow, Samuel Denton**, *F.L.S.*, 120, *Main Street, Port Elizabeth, Cape Colony.*
— **Baker, John Gilbert**, *F.R.S., F.L.S., The Royal Herbarium, Kew (Ex-President).*
1888 Barnes, Richard, *The Gardens, Saltburn-by-the-Sea.*
— Barnes-Lawrence, *Rev. Canon* H. F., *M.A., C.M.Z.S., Birkin Rectory, Ferrybridge.*
— Barnsley Naturalists' Society.
— Barran, John, *M.P., Chapel-Allerton Hall, Leeds.*
— Barwick, John Marshall, *M.A., Low Hall, Yeadon, Leeds.*
1889 Bayford, E. G., *West Melton, Rotherham.*
— Beaumont, Alfred, *F.E.S.*, 153, *Hither Green Lane, Lewisham, London, S.E.*
— Bedford, James, *Sycamore Lodge, Woodhouse, Leeds.*
— **Bedford, James E.**, *F.G.S., Clifton Villas*, 9, *Cardigan Road, Leeds.*
1884 **Bennett, Samuel H.**, *Boston Grove, Rotherham.*
1883 Bethell, William, *J.P., D.L., Rise Park, Hull.*
— Bewlay, Frederick, 6, *Vine Street, York.*
1885 Bidwell, Edward, *M.B.O.U., Fonnereau House, Twickenham, Middlesex.*
1888 Bilbrough, James Wm., *Wharfecote, Ben Rhydding, viâ Leeds.*
1888 Bilbrough, Mrs. J. W., *Wharfecote, Ben Rhydding, viâ Leeds.*
1885 Bingley, Godfrey, *Ash Lea, Cardigan Road, Headingley, Leeds.*
— Birchall, Edward, 18, *Moorland Road, Leeds.*
1884 **Birks, Edward**, *Birchcliffe, Broomhall Park, Sheffield.*
— **Birks, Thomas, jun.**, *South End Mills, Liverpool.*
— Blakeley, John Wesley, *Ramsden Street, Littletown, Liversedge, viâ Normanton.*
1884 Booth, James, *F.G.S., Mayor of Halifax, Spring Hall, Halifax.*
1887 Booth, Walter William, 2, *Woodhouse Cliff, Hyde Park, Leeds.*
— Bothamley, Charles H., *F.I.C., F.C.S., The Yorkshire College, and* 11, *Hillary Street, Leeds.*
— Bould, Charles H., 138, *Halifax Old Road, Huddersfield.*
— Boyd, *the Ven. Archdeacon* William, *D.D., Arncliffe Vicarage, viâ Skipton.*
— **Boyes, Frederick**, *Yorkshire Banking Company, Beverley.*
— Bradford Naturalists' and Microscopical Society.
— Bradford Scientific Association.
1884 **Brady, William E.**, 1, *Queen Street, Barnsley.*
— **Braim, John**, *Pickering, Yorkshire.*

1885 Braithwaite, Wm. D., *Ackworth School, viâ Pontefract.*
1885 Branson, F. W., *F.I.C., F.C.S.*, 24, *Mount Preston, Leeds.*
— Brigg, John, *J.P., F.G.S., Kildwick Hall, viâ Leeds.*
1884 Brittain, Frederick, *Taptonville Crescent, Sheffield.*
— Broadhead, John, 29, *Dodworth Road, Barnsley; and St. John's Colliery, Normanton.*
1885 Broadhead, Seth, 30, *Shambles Street, Barnsley.*
1887 Bromley, John H., 14, *Lodge View, Tong Road, Leeds.*
— **Brook, George,** *F.L.S., F.R.M.S., etc., Lecturer on Embryology in the University of Edinburgh*, 18, *Dalrymple Crescent, Edinburgh.*
— **Brooke, Edward, jun.,** *F.G.S., Oakley House, Edgerton, Huddersfield.*
1885 Brooke, John Arthur, *J.P., Fenay Hall, Huddersfield.*
1887 Brooke, *Ven. Archdeacon* J. Ingham, *M.A., The Vicarage, Halifax.*
— Brooke, *Colonel* Thomas, *J.P., F.S.A., Armitage Bridge, Huddersfield.*
1886 **Brownridge, Chas.,** *Assoc.M.Inst.C.E., F.G.S.*, 104, *Burley Mount, Leeds.*
— Brunton, George, *Hillary Mount*, 169, *Woodhouse Lane, Leeds.*
— **Bunker, Thomas,** 9, *East Parade, Goole.*
— **Butterell, J. Darker,** *M.C.S.*, 4, *Willow Grove, Westwood, Beverley.*
— Butterfield, J. A., 11, *Guildford Road, Greenwich, London, S.E.*
— **Butterfield, E. P. P.,** *Wilsden, near Bingley.*
— **Carter James,** *M.B.O.U., Burton House, Masham, viâ Bedale.*
— **Carter, J. W.,** 30, *Lincoln Terrace, Lincoln Road, Bradford.*
1884 Carter, Thomas, *Boolathana Station, Gascoyne, Western Australia.*
1887 **Cash, William,** *F.L.S., F.G.S., etc., Chairman of Halifax School Board*, 38, Elmfield Terrace, Halifax.
— **Chadwick, Samuel,** *F.G.S., Mount Pleasant, Malton.*
— Chaloner, *Rev.* J. W., *Vicarage, Newton Kyme, Tadcaster.*
1887 Chapman, Abel, *M.B.O.U., Silksworth Hall, Sunderland.*
1886 Chaytor, R. C., *M.C.S., Scrafton Lodge, Middleham, viâ Bedale.*
— **Cheesman, William Norwood,** *The Crescent, Selby.*
— **Clark, James Edmund,** *B.A., B.Sc.*, 20, *Bootham, York.*
1886 Clark, Robert, *Market Place, Pickering.*
1888 Clarke, *Rev.* Alfred, *B.A., Vicarage, Kirkby Malzeard, Ripon.*
— **Clarke, Wm. Eagle,** *F.L.S., M.B.O.U., Nat. Hist. Dept., Edinburgh Museum of Science and Art*; 2, *Braidview Terrace, Morningside, Edinburgh.*
1886 Clarkson, W. C., *L.R.C.P., etc., Darley, Ripley, viâ Leeds.*
1884 Clayton, John, *Boxtree House, Thornton Road, Bradford.*
— Clayton West Naturalists' Society.
1887 Cleveland Naturalists' Field Club.
— Colby, George, *Surgeon, Malton.*
— **Cole,** *Rev.* **E. Maule,** *M.A., F.G.S., Vicarage, Wetwang-on-the-Wolds, viâ York.*
1884 Colley, Francis H., *Sharrow, Sheffield.*
— **Conacher, John, jun.,** 31, *Spring Wood Street, Huddersfield.*
— Coning, —, *Malton.*
1886 Copley, Walter, *Town Hall Street, Sowerby Bridge.*
— **Cordeaux, John,** *M.B.O.U., Great Cotes, Ulceby, Lincolnshire.*
— Coupland, Joseph, *High Harrogate.*
1884 Cover, John Lee, *Sherburn, viâ South Milford.*
1887 Craven Naturalists' Association, *Skipton.*
1887 Crawshaw, C. B., *Bank Terrace, Dewsbury.*
1889 Crawshaw, *Rev.* Charles, *Linden House, Shipley.*
— Creyke, Ralph, *J.P., Rawcliffe Hall, Selby.*
1889 Crosland, G. W. Kilner, *Holmfield, Huddersfield.*
1887 Crossland, Charles, 87, *New Market, Halifax.*
1884 Crossley, William H., *Maltby, near Rotherham.*
1884 Crossley, Miss Frances Ann, *Maltby, near Rotherham.*
1884 Crossley, Miss Mary A. B., *Maltby, near Rotherham.*
1884 Dale, R. Thornton, 27, *Parish Ghyll Road, Ilkley.*
1885 **Dallinger,** *Rev.* **W. H.,** *LL.D., F.R.S., F.L.S., Pres. R.M.S., etc., Ingleside, Newstead Road, Lee, London, S.E.* (*Ex-President*).

1883 Darbishire, R. D., *B.A.*, *F.S.A.*, *F.G.S.*, *Victoria Park, Manchester.*
— **Davis, James William,** *F.S.A.*, *F.L.S.*, *F.G.S.*, *Chevinedge, Halifax.*
— Davison, George, *Garden House, Keldgate, Beverley.*
1888 Dawson, Oswald, *M.C.S.*, *Caledonian House, Leeds.*
1883 Dawson, Percival W., 11, *Wellington Terrace, Beverley Road, Hull.*
1884 Denham, Thomas E., 11, *York Place, New North Road, Huddersfield.*
— **Dennis, George C.,** 11, *Tower Street, York.*
1885 **Denny, Alfred,** *Professor of Biology in the Firth College*; 61, *Brunswick Street, Sheffield.*
— Devonshire, *His Grace the Duke of, K.G., F.R.S., Devonshire House, Piccadilly, London, W.* ; *and Bolton Abbey, Skipton.*
— Dewsbury Naturalists' Society.
1884 **Dickinson, Francis Wm.,** 26, *Bridgegate, Rotherham.*
— **Dobrée, N. F.,** *F.E.S.*, *The New Walk, Beverley.*
— Doncaster Microscopical and General Scientific Society.
1889 Dresser, Henry Eeles, *F.L.S.*, *F.Z.S.*, *etc.*, *Topclyffe Grange, Farnborough, R.S.O., Kent* (*President*).
1889 Drury, Dr., *Ferguson Street, Halifax.*
1883 **Dunning, J. W.,** *M.A.*, *F.L.S.*, *F.E.S.*, 12, *Old Square, Lincoln's Inn, London.*
— **Eddy, J. Ray,** *F.G.S.*, *F.R.M.S.*, *The Grange, Carleton, Skipton.*
— Elland-cum-Greetland Naturalists' Society.
1885 Ellis, H. M., *Westbourne Villas, Beverley.*
1887 Emerson, E. B., *B.A.*, *J.P.*, *Redcar.*
— **Emmet, John,** *F.L.S.*, *The Poplars, Boston Spa, viâ Tadcaster.*
1887 Emmet, Mrs., *The Poplars, Boston Spa, viâ Tadcaster.*
1884 Eskholme, George, *J.P.*, *Beech-en-Hurst, Rotherham.*
1887 Farrah, John, *Crescent Road, Low Harrogate.*
— Faulding, Joseph, *Ebor Villa, Godwin Road, Clive Vale, Hastings.*
— Featherstone, I. Garbutt, *Brompton, viâ York.*
1887 Fisher, *Rev.* Robert, *M.A.*, *Sewerby Vicarage, viâ Hull.*
1887 Fitzgerald, Francis R., *M.C.S., c/o J. Balkin, Howard Road, Dorking, Surrey.*
1888 Fitzwilliam, *Hon.* W. H. Wentworth, *M.P.*, *The Lodge, Malton.*
— **Foggitt, William,** *Market Place, Thirsk.*
1887 Fortune, Riley, *Alston House, Harrogate.*
— Foster, Charles, 5, *King's Place, Headingley, Leeds.*
— Foster, Matthew, *Houghton Hall, Sancton, Brough.*
— **Fowler,** *Rev.* **William,** *M.A.*, *Vicarage, Liversedge, viâ Normanton* (*Ex-President*).
1884 Fox, *Rev.* Henry E., *M.A.*, *M.B.O.U.*, *St. Nicholas' Vicarage*, 12, *South Bailey, Durham.*
1883 **Gallwey,** *Sir* **Ralph Payne,** *Bart.*, *M.B.O.U.*, *Thirkleby Park, Thirsk* (*Ex-President*).
— Gardiner, H. T., *Times Office, Goole.*
1885 Gardner, John, 8, *Friar Terrace, Hartlepool.*
1883 **Gaunt, Leonard,** *Prospect House, Farsley, Leeds.*
1886 Gaunt, Mrs. L., *Prospect House, Farsley, Leeds.*
1887 Gerrard, John, *Government Inspector of Mines, Wakefield.*
1888 Gibb, George S., *LL.B.*, *Chesnut Grove, Heworth, York.*
— Gill, Hugh, *Boston Spa, Tadcaster.*
— Goole Scientific Society.
1883 Gough, Thomas, *B.Sc.*, *F.G.S.*, *Elmfield College, York.*
1886 Grant, Thomas, *Union Street, Pocklington, viâ York.*
— **Grassham, John,** 52, *Lofthouse Place, Leeds.*
1885 Gray, Thomas H., *Brookleigh, Calverley, Leeds.*
— **Green, A. H.,** *M.A.*, *F.R.S.*, *F.G.S.*, *etc.*, *Professor of Geology in the University of Oxford*, 137, *Woodstock Road, Oxford.*
1885 Greenwood, T. W., *Howley View, Batley.*
— **Gregson, William,** *Baldersby, Thirsk.*
1887 **Grimshaw, Percy H.,** 8, *Elm Grove, Burley-in-Wharfedale.*
1888 Grimston, Francis Augustus, *Mozergh House, Kendal.*
1884 Grove, Edmund, *F.R.M.S.*, *Seabank, West Worthing.*

1887 Haigh, G. H. Caton, *Aber-iâ, Penrhyndeudraeth, Merionethshire*; *and Grainsby Hall, Great Grimsby, Lincolnshire.*
— Hailstone, Edward, *F.S.A., Walton Hall, Wakefield.*
— Halifax Scientific Society and Geological Field Club.
1889 Hall, A. E., *Norbury, Pitsmoor, Sheffield.*
1889 Hancock, *Rev.* W. E., *M.A., Vicarage, Knaresborough.*
1887 Handley, John, *Briggflatts, Sedbergh.*
1887 **Hardcastle, C. D.,** 31, *Victoria Place, Leeds.*
1884 Harding, *Rev.* I., *Mere Beck, Long Preston.*
— **Harker, Alfred,** *M.A., F.G.S., Woodwardian Museum, and St. John's College, Cambridge*; *and Spring Bank, Hull.*
— Harrison, John, *Tillage Works, Goole.*
— Harrison, John, *Wilstrop Hall, near York.*
1886 Harrogate and District Naturalists' Society.
1888 Harrogate Ellesmere School Natural History Society.
1885 Harvie-Brown, John A., *F.R.S.E., F.Z.S., M.B.O.U., etc., Dunipace House, Larbert, N.B.*
— Heckmondwike Naturalists' Society.
— Herries, *The Right Hon.* M. F. Constable-Maxwell, *Lord, Lord-Lieutenant of the East Riding, Everingham Park, York.*
— **Hewetson, H. Bendelack,** *M.R.C.S., F.L.S., F.Z.S.*, 10, *Hanover Square, Leeds.*
— Hewett, William, 3, *Wilton Terrace, Fulford Road, York.*
— **Hey,** *Rev.* **Wm. C.,** *M.A., M.C.S., St. Olave's Vicarage, York.*
1883 **Hick, Thomas,** *B.A., B.Sc., Owens College*; *Brighton Grove, Rusholme, Manchester.*
1887 Hill, *Alderman* John, 47, *Victoria Road, Morley.*
— Hindley, A. D., *Liversedge, viâ Normanton.*
— Hirst, Joseph, *Sunset Terrace, Birkby, Huddersfield.*
— **Hobkirk, Charles C. P.,** *F.L.S., West Riding Union Bank, Dewsbury.*
— Hodgson, William, *St. Nicholas Street, Norton, Malton.*
— **Holgate, Benjamin,** *F.G.S., Regent House, Grosvenor Road, Headingley, Leeds.*
1883 Hopkinson, John, *F.L.S., F.G.S., F.R.M.S., etc., The Grange, St. Albans, Herts.*
1884 **Horne, William,** *F.G.S., Market Place, Leyburn, viâ Bedale.*
1889 Howarth, Elijah, *F.R.A.S., Curator of Sheffield Public Museum, Weston Park*; 169, *Northumberland Road, Sheffield.*
1885 Huddart, *Rev.* G. A. W., *M.A., LL.D., Kirklington Rectory, Bedale.*
1884 **Hudleston, Wilfred H.,** *M.A., F.R.S., F.L.S., F.G.S., F.C.S., etc., Oatlands Park, Weybridge, Surrey* (*Ex-President*).
1887 **Hudson, Baker,** *M.C.S.*, 5, *Westbourne Grove, Coatham, Redcar.*
— Hull Field Naturalists' and Scientific Society.
1888 Hull Geological Society.
1888 Hull Scientific Club.
1883 Hurst, Joseph S., *J.P., Copt Hewick Hall, Ripon.*
1884 **I'Anson, Joseph Coventry,** *F.S.A., F.G.S., etc., Glenholme, Saltburn-by-the-Sea.*
— Ingleby, James, *Eavestone, near Ripon.*
— Ingram, Hobson, *Park Terrace, Horsforth.*
1885 Irvin, *Rev.* Benj., *M.A., Vicarage. Saltburn-by-the-Sea.*
1884 Irvine, Charles Stuart, *Lawnswood, Adel, Leeds.*
— Jackson, George, 2, *Clement Street, York.*
— **Jackson, John,** *M.P.S., High Street, Wetherby.*
— **Jessop,** *Rev.* **William,** *F.A.S., Woodcliffe, Rawdon, Leeds.*
1889 Jones, J. E., *Balmoral Place, Halifax.*
— Jowitt, Mrs. Hannah, *Thornton Grove, Ripley, Leeds.*
— Keighley Literary and Scientific Society.
1883 Kendall, Richard Wm., *Union Row, New Street, Selby.*
1888 **Kidston, Robert,** *F.R.S.E., F.G.S.*, 24, *Victoria Place, Stirling, N.B.*
1887 King, John, 27, *Kensington Terrace, Hyde Park, Leeds.*
1884 **Kirk, J. M.,** *High Street, Doncaster.*

— **Knubley,** *Rev.* **E. Ponsonby,** *M.A., M.B.O.U., Staveley Rectory, viâ Leeds.*
— Ladmore, E. J., *Grosvenor Place,* 149, *Manningham Lane, Bradford.*
1884 Lancaster, Wm. J., *Church Street, Barnsley.*
— Law, A. E., *Taptonville, Sheffield.*
1888 Law, Robert, *F.G.S.,* 11, *Cromwell Terrace, Halifax.*
1888 Leach, R. E., *M.A., F.G.S., St. Mary's Cottage, Beccles, Suffolk.*
1883 **Leadman, A. D. H.,** *F.S.A., Boroughbridge, viâ York.*
— **Lee, Phineas Fox,** *West Park Villas, Dewsbury.*
— Leeds Conchological Society.
— Leeds Geological Association.
— Leeds Naturalists' Club.
1887 Leeds Y. M. C. A. Naturalists' Club.
1887 Leyburn Literary and Scientific Society.
1886 Lightfoot, *Rev.* Geo. H., *M.A., The Vicarage, Pickering.*
— Lister, Thomas, 45, *Norfolk Street, King's Lynn, Norfolk.*
— Liversedge Naturalists' Society.
1888 Lloyd, Edward John, *Windspoint, Knowle Road, Totterdown, Bristol.*
1889 Longster, Thomas Piper, *Mowbray Terrace, Malton.*
— Loten, Philip W., *Easington, viâ Hull.*
— Lund, Charles, *Ilkley.*
1884 **Lund, Percy,** *Eldermere, Ilkley.*
— Lupton, Henry, *F.E.S., Lyndhurst, North Grange Road, Headingley.*
— McGhie, Wm. K., *Castle Hill, Rastrick, Brighouse.*
1884 McIntyre, J. W., 2, *Market Place, Sheffield.*
1887 Mackie, *Rev.* John H., *M.A., Sedbergh School, Sedbergh, R.S.O.*
— **McLandsborough, John,** *F.G.S., F.R.A.S., F.R.Met.S., etc.,* 11, *Lindum Terrace, Manningham, Bradford.*
1883 McLean, Donald, *Sutherland Estate Office, Dunrobin, Golspie, N.B.*
1888 Macpherson, Angus, 16, *Teresa Terrace, Coatham, Redcar.*
— Malt, James, 34, *Clyde Street, New Wortley, Leeds.*
— Malton Field Naturalists' and Scientific Society.
1887 Manning, J. B., *The Governor's House, Wakefield.*
1884 Marsh, Robert, jun., *Rotherham.*
— Marshall, John, *F.G.S., Ramsden Wood, Walsden, Todmorden.*
1889 Mason, James Eardley, *S.S.C., The Sycamores, Alford, Lincolnshire.*
— Mason, Philip Brooke, *F.L.S., F.E.S., M.C.S., etc., Burton-on-Trent.*
— **Massee, George E.,** *F.R.M.S.,* 10, *Gloucester Road, Kew, Surrey.*
— Meade, R. H., 1, *Mount Royd, Manningham, Bradford.*
1887 Meek, J. M., 2, *Nelson Terrace, Coatham, Redcar.*
1886 Metcalfe, George, *Castlestead, Pateley Bridge.*
1884 Metcalfe, John Henry, *Leyburn, viâ Bedale.*
— **Miall, Louis C.,** *F.L.S., F.G.S., Professor of Biology in the Yorkshire College;* 5, *Montpellier Terrace, Cliff Road, Leeds.*
1887 Middlesbrough Junior Naturalists' Field Club.
1884 Milner, Miss Edith, *The Cottage, Bishopthorpe, York.*
1884 Mitchell, T. Carter, *Topcliffe, near Thirsk.*
1889 Mitchelson, Thomas, *The Mount, Pickering.*
— **Moiser, Henry R.,** *F.G.S., Heworth Grange, York.*
1887 More, Alexander Goodman, *F.R.S.E., F.L.S., M.R.I.A.,* 92, *Leinster Road, Dublin.*
1883 Morrison, Walter, *M.P., Malham Tarn House, Bell Busk, viâ Leeds.*
1886 Naughton, John, *Ellesmere School, Park View, Harrogate.*
1887 **Nelson, Thomas H.,** *M.B.O.U., Apsley House, Redcar.*
— **Nelson, William,** *M.C.S., Freehold Street, York Road, Leeds.*
1885 Newbitt, Thomas, 1, *Havelock Place, West Cliff, Whitby.*
— Nuttall, William, *Moorside, Eccleshill, Bradford.*
1883 Oldfield, George Wm., *M.A., F.E.S.,* 21, *Longridge Road, Earl's Court, London, S.W.*
1888 Oldroyd, Charles, *Snainton, Heslerton, viâ York.*
1887 Oldroyd, Ed., *Horbury, near Wakefield.*
1886 Oliver, Jesse, *The General Infirmary, Leeds.*

1884 Olsen, O. T., *F.L.S.*, 116, *Stirling Street, St. Andrew's Terrace, Grimsby, Lincolnshire.*
— Ormerod, Thomas, *Woodfield, Brighouse.*
— Ovenden Naturalists' Society.
1888 Oxley, *Rev.* W. H., *M.A., The Cottage, Filey.*
1888 Painter, *Rev.* W. Hunt, *Knypersley Hall, Congleton, Cheshire.*
— Paley, William, *M.D., Ure Bank, Ripon.*
1883 Pallister, John Wm., *B.Sc.*, 28, *Heathfield Terrace, Headingley, Leeds.*
— Pape, Tom, *Helmsley, viâ York.*
— Parkin, George, *York Street, Wakefield.*
— **Parsons, Henry Franklin,** *M.D., F.G.S.*, 13, *Whitworth Road, South Norwood, London, S.E.* (*Hon. Life Member*).
1883 Paterson, A., 25, *Milton Street, Doncaster.*
1883 Paver-Crow, Richard, *J.P., Ornhams Hall, Boroughbridge.*
1888 Payne, C. Arthur, *The School House, Baldersby, Thirsk.*
— Payne, Henry, *M.D., Newhill Hill, West Melton, viâ Rotherham.*
1884 Peach, Robert, *North Park Road, Harrogate.*
— Pearson, Hugh W., *The Mount, Malton.*
— Pease, H. J. Robinson, *J.P., St. Mary's House, Hengate, Beverley.*
— Pease, W., *Elm Cottage, Hook, near Howden.*
1888 Peirse, *Sir* Henry Beresford, *Bart., J.P., Bedale Hall, Bedale.*
1883 Penrith, *Right Rev.* J. J. Pulleine, *D.D., Bishop of, Stanhope Rectory, viâ Darlington.*
1885 **Platnauer, H. M.,** *A.R.S.M., B.Sc., F.G.S., etc., Curator of the York Museum; Low Royd, St. Olave's Road, York.*
— Pocklington, Christopher, *F.R.M.S.*, 22, *Cunliffe Villas, Manningham, Bradford.*
— Pocklington, Henry, *F.R.M.S., Cedar Grove, Armley, Leeds.*
1889 Pocklington Literary and Philosophical Society.
— Pollard, Harry, 19, *Britannia Terrace, New Wortley, Leeds.*
— **Porritt, Geo. T.,** *F.L.S., F.E.S., Greenfield House, Huddersfield.*
1889 Potter, Francis Henry, 7, *Blenheim Terrace, Leeds.*
— Powell, Francis Sharp, *M.P., Horton Old Hall, Bradford.*
1888 Powell, *Rev.* Thomas, *M.A., Healey Vicarage, viâ Bedale.*
1887 Powys, *Rev.* H. Annesley, *M.A., Meanwood Vicarage, Leeds.*
1886 Practical Naturalists' Society (Yorkshire Members), *London.*
1883 Priestman, Frederick, *J.P., Pierremont, Manningham, Bradford.*
1884 Prodham, Herbert, *Allerston, near Pickering.*
— Proudlock, John, *The Nurseries, Market Weighton, R.S.O.*
1887 Pyman, Walter H. S., *Moss Brow, Whitby.*
1885 Radcliffe, *Sir* J. Percival, *Bart., F.R.A.S., Rudding Park, Knaresborough.*
— Rawson, F. G. S., *Thorpe, near Halifax.*
1887 Reynolds, Richard, *F.C.S., Cliff Lodge, Hyde Park, Leeds.*
— Richardson, Hugh, *M.C.S., Sedbergh School, Sedbergh, R.S.O.*
— **Ridgway, J. Ambrose,** *F.R.A.S., The Foundation School, Beverley.*
— Ripon, *The Most Hon.* George Frederick Samuel Robinson, *Marquis of, K.G., F.R.S., etc., Studley Royal, Ripon.*
— Ripon Naturalists' Club and Scientific Association.
— Ripponden Naturalists' Society.
— **Roberts, George,** *M.C.S., Lofthouse, near Wakefield.*
1887 Robinson, William, *Green Bank, Sedbergh, R.S.O.*
— **Roebuck, Wm. Denison,** *F.L.S., M.C.S., Sunny Bank, Leeds.*
— Rookledge, John, *F.R.M.S., York Union Banking Company, Easingwold.*
— Roper, W. Greaves, *The Hollies, Spring Hall, Sheffield.*
— Ross, Lewis Buttle, *F.C.S., etc., Driffield.*
1883 Rotherham Naturalists' Society.
1884 Roundell, Chas. Savile, 16, *Curzon Street, Mayfair, London.*
1889 Rowley, Brooke, 52, *Moorfield Terrace, Halifax.*
— Rowley, Walter, *M.Inst.C.E., F.G.S., etc., Alder Hill, Meanwood, Leeds.*
1887 Rowntree, Frank H., *Kildare House.* 163, *Highbury New Park, London, N.*
— **Rowntree, James H.,** *Westwood, Scarborough.*
— Russell, Wm. B., *LL.B.*, 157, *Chapeltown Road, Leeds.*

1888 St. Paul, *Major*, *The Willows*, *Ripon*.
— Salter, John Henry, *Newtown School*, *Waterford*, *Ireland*.
1884 Sawdon, Fred. John, *M.D.*, 3, *Lansdowne Terrace*, *Beverley Road*, *Hull*.
— Saynor, Benj., 4, *Kellam Street*, *Accommodation Road*, *Leeds*.
1887 Scarborough Philosophical and Archæological Society.
— Scargill, A., *East Parade*, *Sheffield*.
1889 Scharff, Robert F., *B.Sc.*, *Ph.D.*, *M.C.S.*, *Curator*, *Nat. Hist. Museum*, *Dublin*.
1883 **Scott, Walter Cecil,** *Chadhurst*, *Otley Road*, *Far Headingley*, *Leeds*.
1888 Scrope, Simon Thomas, *J.P.*, *D.L.*, *Danby Hall*, *Bedale*.
— Sheffield Naturalists' Club.
— Shepherd, C. W., *Brook Street*, *Ilkley*.
— Shuffrey, *Rev.* W. A., *M.A.*, *Halton Gill Vicarage*, *Arncliffe*, *viâ Skipton*.
— Siddell, Geo., 3, *Christ Church Road*, *Pitsmoor*, *Sheffield*.
1888 Silabon, George, *Waterhouse Lane*, *Hull*.
— Sims, Henry, 13, *All Hallowgate*, *Ripon*.
— **Slater,** *Rev.* **Henry H.,** *M.A.*, *F.Z.S.*, *M.B.O.U.*, *Irchester Vicarage*, *Wellingborough*, *Northamptonshire*.
— **Slater, Matthew B.,** *F.L.S.*, 1, *West Grove Villas*, *Newbiggin*, *Malton*.
1888 Smith, Christopher W., *Harome*, *Nawton*, *viâ York*.
1883 Smith, *Rev.* Henry, *M.A.*, *Middleton-One-Row*; *and Clarendon House*, *Redcar*.
1884 Somerset, Herbert, *Regent Square*, *Doncaster*.
— **Soppitt, Henry Thomas,** 3, *Rosemount*, *Bolton*, *Bradford*.
— **Sorby, Henry Clifton,** *LL.D.*, *F.R.S.*, *F.L.S.*, *F.G.S.*, *F.R.M.S.*, *etc.*, *Broomfield*, *Sheffield* (*Ex-President*).
1885 Speight, Harry, *Gaythorne View*, *West Bowling*, *Bradford*.
— **Spencer, James,** 8, *Salisbury Place*, *Akroydon*, *Halifax*.
— Spurling, John, 42, *Northgate*, *Wakefield*.
— Standen, Robert, *M.C.S.*, 40, *Palmerston Street*, *Moss Side*, *Manchester*.
— **Stead, John James,** *Albert Cottage*, *Heckmondwike*.
1886 **Stears, John,** 125, *Coltman Street*, *Hull*.
— Steel, R. Elliot, *M.A.*, *Spring Cliffe House*, *Heaton Road*, *Bradford*.
1884 **Stiles, M. H.,** 2, *Frenchgate*, *Doncaster*.
— Stoks, Edwin, *New York*, *Rawdon*, *Leeds*.
1883 Stott, Walter Henry, *Southwell House*, *Hall Gate*, *Doncaster*.
1889 Strickland, Walter W., 3, *Rosemont Villas*, *Richmond*, *Surrey*.
1884 **Stuart, J. A. Erskine,** *L.R.C.S. Ed.*, *etc.*, *Staincliffe*, *Dewsbury*.
— **Stubbins, John,** *F.G.S.*, *F.R.M.S.*, *Inglebank*, *Far Headingley*, *Leeds*.
— **Summerfield,** *Rev.* **R. A.,** *B.A.*, *North Stainley Vicarage*, *near Ripon*.
— Swailes, Johnson C., *Toll Gavel*, *Beverley*.
1887 **Tate, Thomas,** *F.G.S.*, 5, *Bagby Road*, *Woodhouse*, *Leeds*.
— **Taylor, John W.,** *F.L.S.*, *M.C.S.*, *etc.*, *Outwood Villa*, *Horsforth*, *Leeds*.
1884 Taylor, *Rev.* R. Vickerman, *B.A.*, *Melbecks Vicarage*, *viâ Richmond*, *Yorkshire*.
— Taylor, Vincent, *B.A.*, *Burnside School*, *Ilkley*.
— Taylor, W. W., *M.A.*, *Hawthornden*, *Grove Hill*, *Forest Hill*, *London*, *S.E.*
— **Teasdale, Washington,** *F.R.A.S.*, *F.R.M.S.*, *Rosehurst*, *Headingley*, *Leeds*.
— Terry, James, 29, *Holmes Street*, *Westgate*, *Bradford*.
— Tetley, Charles F., 47, *Cardigan Road*, *Headingley*, *Leeds*.
— Tew, Thos. Wm., *J.P.*, *Carleton Grange*, *Pontefract*.
1886 Thirkettle, George, 18, *Claremont Road*, *Headingley*, *Leeds*.
1887 Thirsk Natural History Society.
1884 Thompson, *Major* Ben. Blaydes, 11, *Franklin Parade*, *Harrogate*.
1884 Thompson, Richard, *Park Street*, *The Mount*, *York*.
1886 Thompson, *Rev.* Wm., *M.A.*, *J.P.*, *Guldrey Lodge*, *Sedbergh*, *R.S.O.*
— Thrippleton, John, *Burley View*, *Burley*, *Leeds*.
— **Tindall, Edward,** *Knapton Hall*, *Rillington*, *York*.
— Tindall, George, *High Street*, *Newmarket*, *Suffolk*.
1884 Travis, *Rev.* William Travis, *M.A.*, *Rectory*, *Ripley*, *viâ Leeds*.
1886 Trickett, John, *Dacre Banks*, *viâ Leeds*.
1889 Turner, Benjamin, 10, *Pitt Street*, *Barnsley*.

1889 Vine, George Robert, 112, *Hill Top, Attercliffe, Sheffield.*
1888 **Waite, Edgar R.,** *Headingley, Leeds.*
— Waite, William, *Park Mill, Clayton West, viâ Huddersfield.*
1888 Waite, Zechariah, 6, *George Street, Whitby.*
— Wake, C. Staniland, *M.A.I., Welton, near Brough.*
1889 Wakefield, *The Right Rev.* William Walsham How, *D.D., etc., Lord Bishop of, South Parade, Wakefield.*
— Wakefield Naturalists' and Philosophical Society.
1888 Walker, A. W., *York and East Riding Bank, Malton.*
1888 Walker, Miss Gertrude, *Lees House, Thornhill Lees, Dewsbury.*
1884 Walker, *Councillor* Isaac, 11, *Lindum Terrace, Rotherham.*
1887 **Walker, Samuel,** 75, *Union Terrace, York.*
— **Walsingham,** *The Right Hon.* **Thomas De Grey,** *Lord, M.A., F.R.S., F.L.S., Pres.E.S., etc., Merton Hall, Thetford, Norfolk; and Blubberhouses, Yorkshire* (*Ex-President*).
1884 **Walton, F. Fielder,** *M.R.C.S., F.G.S.,* 46, *Mason Street, Hull.*
— Ward, George, *F.I.C., F.C.S.,* 1, *Buckingham Terrace, Hyde Park, Leeds.*
1883 Ward, H. Snowden, *The Country Press, St. John's Street, Bradford.*
1884 Ward, Seth, *Fairfields, Dewsbury.*
1887 Ward, Thomas F., *Park Road South, Middlesbrough.*
1885 Watson, Arnold Thomas, *Southwold, Tapton Crescent, Sheffield.*
1887 Watson, John W., *Redcar.*
1887 Watts, *Rev.* Arthur, *F.G.S., F.R.G.S., Vice-Principal of Bede College, Durham; Manor House, Shincliffe, Durham.*
1888 Weetman, Henry, *F.Z.S., Howden House, Derwent, Sheffield; and The Hawthorns, Little Haywood, Stafford.*
— **West, William,** *F.L.S.,* 15, *Little Horton Lane, Bradford.*
— Wharncliffe, *The Right Hon.* E. M. S. G. Montagu-Stuart-Wortley-Mackenzie, *Earl of, Wortley Hall, near Sheffield.*
1886 Whincup, Richard, *Scotgate Ash Quarries, Pateley Bridge.*
1885 Whitaker, Joseph, *F.Z.S., M.B.O.U., Rainworth Lodge, Mansfield, Nottinghamshire.*
— Whitaker, T. Stephen, *F.R.G.S., Everthorpe, Brough.*
1889 Whiteley, Frederick, *Clare Road, Halifax.*
— **Whitwell, William,** *M.C.S., Roslin,* 4, *Thurleigh Road, Balham, London, S.W.*
— **Williamson, William Crawford,** *LL.D., F.R.S., Professor of Biology in the Owens College; Fallowfield, Manchester* (*Ex-President*).
— Wilson, John, *J.P., Seacroft Hall, Leeds.*
— Wilson, John H., 5 *and* 6, *West Park, Harrogate.*
— **Wilson, J. E.,** 8, *Summerseat Place, Bradford.*
1887 Wilson, J. Mitchell, *M.D.,* 51, *Hall Gate, Doncaster.*
— Winter, George, 3, *St. George Gate, Doncaster.*
— Wood, John, *B.A., F.R.A.S., Wharfedale College, Boston Spa, viâ Tadcaster.*
1888 **Woodall,** *Major* **John W.,** *M.A., J.P., F.G.S., etc., St. Nicholas House, Scarborough.*
1883 Woodd, Basil T., *J.P., D.L., Conyngham Hall, Knaresborough.*
— Woodd, Charles H. L., *J.P., F.G.S., Oughtershaw Hall, Buckden, viâ Skipton.*
— **Wrigglesworth, E. B.,** *Clarendon Street, Wakefield.*
— Wright, John, *Terrington, viâ York.*
Yewdall, Edwin, 58, *Wade Lane, Leeds.*
— York Field Naturalists' and Scientific Society.
1888 Young, William, *M.D., Castlegate House, Malton.*

The Secretaries of the Union will be glad to be informed of any changes of address or corrections in the above list.

LEEDS:
PRINTED BY M'CORQUODALE & CO. LIMITED.

ANNUAL REPORT FOR 1889

(NOVEMBER 1889),

AND

SUPPLEMENTARY LIST OF MEMBERS,

31st OCTOBER, 1890.

YORKSHIRE NATURALISTS' UNION.

28th ANNUAL REPORT, for 1889.

Your Executive, in presenting the 28th Annual Report and Statements of Accounts, have to pass in review a year of successful work, whether as regards the interest maintained in the Excursions, the value of the publications, or the amount of work achieved by the various Committees appointed for special research.

The Meetings which have been held during the year have been five in number, one in each division of the county, the places and dates having been as follows:—

Huddersfield for Holmfirth Valley, Whit-Monday, June 10th.
Robin Hood's Bay and the Peak, Friday, June 21st.
Harrogate for Plumpton and Rudding Parks, Saturday, July 13th.
Upper Teesdale, Saturday to Bank Holiday Monday, August 3rd to 5th.
Malton for Kirkham Abbey and Acklam Brow, Wednesday, September 4th.

For each of these meetings the usual descriptive circular, which is so conducive to the convenience of members and associates undertaking the day's explorations, was issued, and at all the meetings good results were achieved.

The opening meeting, arranged for Whit-Monday, at Huddersfield, was well attended, notwithstanding the threatening aspect of the weather. The country chosen for investigation was the millstone grit district lying S.W. of Holmfirth, including the Holme Valley, Bilberry Reservoir, Ramsden Edge and Harden Moss. The meeting was held at Huddersfield, Mr. Chas. P. Hobkirk, F.L.S., President of the Botanical Section, being in the chair.

It will be remembered that the excursion which was planned last year (1888) for visiting the Peak or South Cheek of Robin Hood's Bay, was but poorly attended, owing to the incessant rain. It was therefore arranged that the same ground should be again visited, and the second excursion of this year took place there, on the 21st of June, when there was a large attendance, attracted partly by the fine weather and beautiful scenery, partly by the fact that the excursion was under the leadership of a distinguished ex-president of the Union, Mr. W. H. Hudleston, F.R.S. The Marine Zoology Committee were able on this occasion to do good work by means of a steam launch and trawl, which was kindly placed at their disposal by Major Woodall. The general meeting was held at Whitby, under the chairmanship of the Rev. E. Maule Cole, M.A., President of the Geological Section.

The third excursion was held at Harrogate, on Saturday, the 13th of July, for the investigation of the Crimple Valley, Rudding and Plumpton Parks, and the geological exploration of Hampsthwaite and Clint. At the general meeting the chair was successively occupied by Mr. Thomas Bunker, President of the Vertebrate Section, and Rev. R. A. Summerfield, B.A.

A departure from the usual practice of the Union was made in the case of the fourth excursion, when the meeting which was held at the High Force Inn, on Bank Holiday Monday, the 5th of August, was preceded by a three-days' excursion commencing on the Saturday previous, for the investigation of the south or Yorkshire bank of the Tees from Middleton up to the junction with Maize Beck. At the meeting, which was attended by about forty members, the chair was occupied by the President of the Union, Mr. H. E. Dresser, F.L.S., who on this occasion made his first acquaintance with the Union and its members.

The excursion programme was brought to a successful termination on Wednesday, the 4th of September, when a visit was paid to the lovely valley of the Derwent at Kirkham Abbey and Howsham Woods, the geologists examining the N.W. escarpment of the wolds at Acklam Brow. The meeting was held at Malton, the chair being occupied by the Rev. W. C. Hey, M.A., President of the Conchological Section.

On all these occasions the Union has been indebted to the kindness which the land-owners of Yorkshire have always been so ready to manifest in facilitating research on their estates; and the facilities which the various railway companies which run on Yorkshire soil have granted, have contributed their share to promoting the success of the Union's investigations.

The Societies which constitute the Union are now forty in number, as against thirty-eight last year, the loss of two—the Ripponden Society, which has ceased to exist, and the Bradford Microscopical Society, now amalgamated with the Bradford Naturalists' Society—being more than counterbalanced by the accession of four Societies, three of them (Pocklington Literary and Philosophical Society, Purlwell Field Club, and Yeadon Geological Society) being newly-founded organisations, and the fourth (Huddersfield Naturalists' Society), the veteran society which took a leading part in the original foundation of the Union twenty-eight years ago, and which it is a pleasure again to enrol on the list.

The statistics with which the secretaries of the different Societies are good enough to furnish the Union from year to year show a considerable increase in the number of Associates, the total membership

of the 40 Societies being now 2,517, or an increase of 408. This, with the number of direct members added, makes the total numerical strength of the Union amount to about 2,925.

The Membership now stands at 410, an increase of 35 on the previous year. During the year 60 new members have been elected, and in this connection the Union has been much indebted to several of its Hon. Local Treasurers and to other members for the successful exercise of their influence with such of their friends as take interest in natural history, or whose sympathies incline them to support the work which the Yorkshire Naturalists' Union carries on. It will not be invidious to mention here that the Union is especially indebted to its old friend Mr. S. Chadwick, of Malton, who has been directly instrumental in securing nearly half of the total number of new members elected during the year.

The Financial Position of the Union has materially improved during the year, owing to the unremitting and vigorous attention which your Hon. Treasurer and the various Hon. Local Treasurers have given to the collection of the very large amount of outstanding arrears which was reported last year as resulting from the total disablement of your Honorary Secretaries during the year 1888. The persistent attention given to this matter has had the result that not only have arrears been collected to the amount shown in the balance-sheet, but the current year's subscriptions have been collected to an amount which has never been shown for a current year in any previous balance-sheet. Much credit is due to the Hon. Local Treasurers for the very considerable and valuable service which is thus rendered by them to the Union. In several of the collecting districts there are at present no arrears whatever outstanding, and it is trusted that during the coming year this state of things may have become the case in all the districts.

Much, however, depends upon the members themselves, who can, by prompt payment of their contributions, do very much to lighten the heavy burden which is always cast upon an hon. treasurer, and in connection with this subject it is to be noted with satisfaction that a considerable number of members have signed the form which authorizes the payment of their subscriptions to the Union's bankers by their own bankers, a course which prevents subscriptions falling into arrear, and which saves much trouble, not only to the honorary officers of the Union, but to the members themselves.

It may be here noted that a little misunderstanding has existed in the case of a few members (fortunately, not many) who have not taken into consideration the absolute necessity of a definite and written resignation being tendered by every member wishing to dis-

continue his subscription. It may be pointed out that members on election sign a form in which they undertake to pay their subscriptions 'until further notice,' and that it is very needful, in order to obviate all risk of misunderstanding, that such notice of withdrawal be in writing, and forwarded direct to the Hon. Secretaries; and it should be further noted that any such notice expires at the end of the year in which it is given. It hardly needs to be added that some such arrangement be made, in order that the Union may be able to discharge its own financial engagements entered into on the basis of the subscriptions realising their nominal amount.

The Publications of the Union have been as in previous years.

The Transactions.—Part 12 was issued in January last, and Part 13 within the past few weeks, both consisting of sheets of the re-issue of Mr. Baker's valuable work on 'North Yorkshire: its Geology, Climatology, and Botany,' of the latter portion of which the Natural Order Caryophyllaceæ has been reached.

The printers are proceeding with the sheets intended to form the next instalment of 'North Yorkshire,' and the continuations of other papers are in course of preparation by their respective authors. Messrs. Clarke and Knubley are engaged upon the 'Birds of Yorkshire'; Messrs. Nelson and Taylor upon the list of Yorkshire Mollusca, and Rev. W. C. Hey upon that of Coleoptera—of all of which sheets will be printed as soon as received from the authors.

The Library continues to increase by means of donations and exchanges. The necessity for increased accommodation which was referred to in the last annual report, has been met during the year—partly by the purchase of a new bookcase, but chiefly through the kindness of the Committee of the Leeds Mechanics' Institution, a body to whom the Union has been indebted in so many ways in the past, who have placed at the Union's service a different room. which affords much superior accommodation and greater convenience. The consequent removal of books and other property has delayed the completion of the administrative work upon which the Librarian was engaged at the date of the last report.

The Sections of the Union have carefully carried on their work during the year, and it is to their efficient working that the success attending the excursions has been attributable.

Committees of Research.—This important feature of the Union's work has been further developed during the past year, by the appointment of a new Committee, viz., on the Erosion of the Yorkshire Coast.

The Boulder Committee has again accomplished a large amount of valuable and highly-appreciated work, as shown by their Report,

which was published in full in 'The Naturalist' for October 1889, and the great importance of what they have done has again been fully and generously acknowledged at the British Association meeting.

The operations of the Marine Zoology Committee have been mainly confined to a couple of dredging expeditions, the first on the occasion of the Union excursion to Robin Hood's Bay, the second in co-operation with members of the Leeds Naturalists' Club. On both occasions numerous specimens were obtained, some of which remain to be submitted to specialists. Some difficulty was experienced from the want of proper dredging appliances, without which it is impossible to obtain many of the smaller organisms, and the Committee consider it very desirable that such apparatus be procured in view of next season's work. The report has already appeared in 'The Naturalist.'

The Fossil Flora Committee has prepared the first portion of a report on their subject from the pens of Mr. William Cash and Mr. Robert Kidston, which your Executive hope shortly to publish.

The Coast Erosion Committee have had careful measurements at certain points on the coast made for future reference, beyond which their inquiries have not been as yet extended.

Proposals will be brought forward at the present meeting for the appointment of three additional Committees, to deal with important subjects upon which the British Association has this year decided to take action, and in which it is highly desirable that all local Societies should co-operate.

One of these is to be for investigating the causes of the Disappearance of Native Plants, and a second for collecting and recording Geological Photographs of Yorkshire sections. The third committee is for the investigation of the Invertebrate Fauna and Cryptogamic Flora (microscopic forms of life) of the fresh waters of the county, and your Executive recommend that the existing Section G (Micro-Zoology and Micro-Botany) be converted into such committee. It is manifestly impossible for work on such a subject to be carried on and reported upon at the meeting in the same manner as the work of the other sections of the Union.

British Association.—The Union has again been selected as one of the Corresponding Societies of the British Association, and was represented at the Newcastle meeting of the Association by the Rev. E. P. Knubley, M.A., whose detailed report was published in 'The Naturalist' for November 1889.

The next meeting of the Association is to be held at Leeds in September next, when it is hoped that all Yorkshire naturalists will do what lies in their power to make it a thorough scientific success.

New Members of General Committee.—Your Executive recommend that Mr. R. Barnes of Saltburn, Mr. Godfrey Bingley of Leeds, Mr. James Booth, Mayor of Halifax, Mr. Frederick Brittain of Sheffield, Mr. Riley Fortune of Harrogate, Mr. John Gerrard of Wakefield, Mr. Hugh Richardson of Sedbergh, Mr. Henry Speight of Bradford, Dr. F. J. Sawdon of Hull, and Mr. Thos. F. Ward of Middlesbrough, be the ten additional permanent members of the General Committee for this year.

Your Executive have again considered the desirability of the members having a direct voice in the choice of representatives on the General Committee, and they hereby recommend that in future the ten additions made annually to the list of permanent members be made by vote of the members, the voting to be by written communications forwarded to the Hon. Secretaries, and afterwards examined and reported upon by scrutineers to be appointed by the General Committee at the Annual Meeting.

The Presidency.—In conclusion, your Executive have to announce that the office of President has been accepted by the Right Rev. Wm. Walsham-How, Lord Bishop of Wakefield—a naturalist of old standing, who in years gone by was successively the founder, hon. secretary, and president of the Oswestry Field Club, one of the most successful of the Field Clubs of the West of England.

Your Executive have further to express their warm sense of gratitude to the retiring President, Mr. H. Eeles Dresser, for the honour which he has conferred upon the Union by his tenure of the office.

YORKSHIRE NATURALISTS' UNION.

ANNUAL MEETING AT HULL.

The 28th Annual Meeting was held in the Royal Institution, Hull, on Wednesday, the 20th November, 1889, and the thanks of the Union are due to the Hull Societies, and to the various local gentlemen who had made the arrangements for the day's proceedings.

The attendance was not quite so large as usual, Hull being so far distant from the mass of the population of the county, but a considerable number of local members were present, and some had journeyed long distances, these being principally representatives of the various local societies.

The Sections met at 4.0 o'clock for the consideration of their reports and the election of their officers, and were followed at 4.30 by the meeting of the General Committee, at which eleven Societies were officially represented by delegates, and six others unofficially by permanent members of the General Committee. In addition to these gentlemen, the attendance included two ex-Presidents (Dr. H. C. Sorby, F.R.S., and Rev. W. Fowler, M.A.), the two Hon. Secretaries (Mr. W. Denison Roebuck, F.L.S., and Rev. E. P. Knubley, M.A.), and one Hon. Assistant Secretary (Mr. Edgar R. Waite), two members of the Executive, three Presidents and four Secretaries of Sections, two of the Hon. Local Treasurers, and two other permanent members of the General Committee, making a total attendance of thirty-five members of Committee.

The chair was taken by Dr. H. C. Sorby, F.R.S., and the minutes of the previous meeting taken as read. The 28th Annual Report, which appears on page 139 of 'The Naturalist' for May, was read by the Rev. E. P. Knubley, M.A., one of the Secretaries, and unanimously adopted, on the motion of Mr. J. J. Stead, seconded by Mr. J. M. Kirk.

The Excursion-programme for 1890, which had been drawn up by the Executive, was adopted as follows, on the motion of the Rev. E. M. Cole, M.A., F.G.S., and Mr. S. A. Adamson, F.G.S.

Whit-Monday, 26th May—Driffield for Lowthorpe.
Saturday, 14th June—Dewsbury for Bretton Park.
Tuesday, 8th July—Kildale-in-Cleveland.
Saturday, 2nd August, to Bank Holiday Monday, 4th August—Upper Swaledale (Gunnerside, Kisdon, and Keld).
Thursday, 11th September - Malham and Gordale (in connection with the meeting of the British Association).

The Secretary read a letter signed by Mr. J. W. Davis, F.S.A., F.G.S., on behalf of the Scientific Societies of Halifax and district, cordially inviting the Union to hold its next Annual Meeting at Halifax. The invitation was unanimously accepted, on the proposition of Mr. Jas. Spencer and Dr. F. F. Walton.

The election of officers next took place, when the Rev. W. Fowler, M.A., announced that the Lord Bishop of Wakefield had accepted the Presidency for 1890.

Both the Hon. Secretaries (Mr. Wm. Denison Roebuck, F.L.S., Leeds, and the Rev. E. Ponsonby Knubley, M.A., M.B.O.U., Staveley), and the Assistant Hon. Secretaries (Messrs. P. H. Grimshaw and Edgar R. Waite, both of Leeds), were unanimously re-elected, on the motion of the Revs. W. Fowler, M.A., and E. Maule Cole, M.A. The Hon. Librarian, Mr. Charles Brownridge, F.G.S., was re-elected, as were also the ten retiring members of the Executive, Rev. W. Fowler, M.A., Liversedge; Messrs. S. A. Adamson, F.G.S., Leeds; J. W. Davis, F.S.A., F.G.S., Halifax; Wm. Cash, F.L.S., Halifax; C. P. Hobkirk, F.L.S., Dewsbury; John Emmet, F.L.S., Boston Spa; Benj. Holgate, F.G.S., Leeds; H. T. Soppitt, Bradford; J. J. Stead, Heckmondwike; and M. B. Slater, F.L.S., Malton. Messrs. J. E. Bedford, F.G.S., and C. D. Hardcastle, both of Leeds, were re-elected Hon. Auditors.

The following Hon. Local Treasurers were also re-elected—Messrs. W. E. Brady, Barnsley; J. D. Butterell, Beverley; H. Speight, Bradford; P. F. Lee, Dewsbury; Geo. Winter, Doncaster; Thos. Bunker, Goole; Wm. Cash, F.L.S., Halifax; Edgar R. Waite, F.L.S., Leeds; M. B. Slater, F.L.S., Malton; T. F. Ward, Middlesbrough; T. H. Nelson, M.B.O.U., Redcar; Rev. R. A. Summerfield, B.A., Ripon; Messrs. J. H. Rowntree, Scarborough; W. N. Cheesman, Selby; A. T. Watson, Sheffield; J. J. Stead, Spen Valley; Geo. Parkin, Wakefield; Thos. Newbitt, Whitby; and G. C. Dennis, York, together with the following new Treasurers—Messrs. L. B. Ross, F.C.S., Driffield; Riley Fortune, F.Z.S., Harrogate; John Stears, Hull; R. Barnes, Saltburn; H. Richardson, B.A., Sedbergh; and Wm. Fletcher, Pickering.

The Committees of Research were then appointed.

The Yorkshire Boulder Committee was re-appointed, to consist of Prof. L. C. Miall, F.L.S., F.G.S., Leeds (chairman); Messrs. C. D. Hardcastle, Leeds (vice-chairman); S. A. Adamson, F.G.S., Leeds (hon. secretary); J. E. Bedford, F.G.S., C. Brownridge, F.G.S., Leeds; S. Chadwick, F.G.S., Malton; Rev. E. Maule Cole, M.A., Wetwang; J. W. Davis, F.G.S., F.S.A., Halifax; Prof. A. H. Green, M.A., F.R.S., Oxford; Wm. Gregson, Baldersby; B. Holgate, F.G.S.,

Leeds; Wm. Horne, F.G.S., Leyburn; James Spencer, Halifax; T. Tate, F.G.S., Leeds; J. W. Woodall, F.G.S., Scarborough; J. R. Mortimer, Driffield, and R. Wood, M.D., Driffield, and the Rev. H. W. Crosskey, M.A., as an honorary member.

The Yorkshire Marine Zoology Committee was re-appointed as follows:—Dr. H. C. Sorby, LL.D., F.R.S., Sheffield (chairman); Messrs. J. P. A. Davis, Halifax (hon. secretary); G. Brook, F.L.S., Edinburgh; J. D. Butterell, Beverley; W. Eagle Clarke, F.L.S., Edinburgh; John Cordeaux, M.B.O.U., Great Cotes; W. Cash, F.L.S., Halifax; Rev. W. C. Hey, M.A., York; Baker Hudson, M.C.S., Redcar; T. H. Nelson, M.B.O.U., Redcar; O. T. Olsen, F.L.S., Grimsby; Rev. H. Smith, M.A., Redcar; J. W. Woodall, M.A., F.G.S., Scarborough; and Geo. Massee, F.R.M.S., Kew, as Botanical Referee.

The Yorkshire Fossil Flora Committee was also re-appointed, to consist of Prof. W. C. Williamson, LL.D., F.R.S., Manchester (chairman); James W. Davis, F.L.S., F.G.S., F.S.A., Halifax (vice-chairman); Wm. Cash, F.G.S., F.L.S., Halifax (hon. secretary); Messrs. S. A. Adamson, F.G.S., Leeds; Thos. Hick, B.A., B.Sc., Manchester; B. Holgate, F.G.S., Leeds; R. Kidston, F.G.S., F.R.S.E., Stirling; Robert Law, F.G.S., Halifax; Prof. L. C. Miall, F.L.S., F.G.S., Leeds; James Spencer, Halifax; John Stubbins, F.G.S., F.R.M.S., Leeds; and William West, F.L.S., Bradford.

The Yorkshire Coast Erosion Committee was re-appointed, to consist of Mr. J. W. Woodall, F.G.S. (chairman), and the Rev. E. M. Cole, M.A. (hon. secretary), Mr. J. C. I'Anson, F.S.A., F.G.S., Saltburn-by-the-Sea, and F. Fielder Walton, F.G.S., Hull.

It was then unanimously resolved that the present Section for Micro-Zoology and Micro-Botany be transformed into a Committee of Research, dealing with the same branch of study and working in connection with the British Association Committee on the same subject, to consist of Dr. H. C. Sorby, LL.D., F.R.S., Sheffield (chairman); J. M. Kirk, Doncaster (hon. secretary); W. West, F.L.S., Bradford; Prof. Alfred Denny, F.L.S., Sheffield; C. B. Crawshaw, Dewsbury; C. P. Hobkirk, F.L.S., Dewsbury; Rev. W. E. Hancock, M.A., Knaresborough; Chas. Crossland, Halifax; and M. H. Stiles, Doncaster.

A new Committee was then appointed to investigate the causes of the Disappearance of Native Plants, to consist of the following members:—C. P. Hobkirk, F.L.S., Dewsbury (chairman); P. F. Lee, Dewsbury (hon. secretary); J. Emmet, F.L.S., Boston Spa; M. B. Slater, F.L.S., Malton; Rev. W. A. Shuffrey, M.A., Arncliffe; Rev. W. Thompson, M.A., Sedbergh; J. H. Phillips,

Scarborough; T. W. Woodhead, Huddersfield; H. T. Soppitt, Bradford; R. Barnes, Saltburn-by-the-Sea; and E. Birks, Sheffield.

A second new Committee was appointed to collect and record Geological Photographs of Yorkshire, and to consist of J. W. Davis, F.S.A., F.L.S., F.G.S., Halifax (chairman); S. A. Adamson, F.G.S., Leeds (vice-chairman); J. E. Bedford, F.G.S., Leeds (hon. secretary); Rev. E. M. Cole, M.A., F.G.S., Wetwang; Godfrey Bingley, Leeds; F. W. Branson, F.I.C., F.C.S., Leeds; G. Fowler Jones, Malton; A. E. Nichols, Leeds; and F. F. Walton, F.G.S., Hull.

The General Committee exercised its power to add to its own number ten permanent members annually in favour of R. Barnes, Saltburn; Godfrey Bingley, Leeds; James Booth, F.G.S., Halifax; F. Brittain, Sheffield; R. Fortune, Harrogate; J. Gerrard, Wakefield; H. Richardson, B.A., Sedbergh; F. J. Sawdon, M.D., Hull; H. Speight, Bradford; and T. F. Ward, Middlesbrough.

The following gentlemen whose names had been duly proposed and seconded in writing were unanimously elected Members of the Union:—H. J. Barber, Brighouse; J. H. Buchanan, M.D., Thirsk; Wm. Cooper, C.E., Hull; H. T. Hallimond, Saltburn; A. M. Jackson, Hull; A. O. Jones, M.D., Harrogate; B. B. Le Tall, M.A., York; W. T. H. Nassau, Hull; A. E. Nichols, Leeds; Walter Roberts, Doncaster; F. A. Scott, Hull; W. H. St. Quintin, J.P., Scampston; M. L. Thompson, Saltburn; C. O. Trechmann, Ph.D., Hartlepool; and R. A. Worswick, Saltburn.

The Scarbro' Field Naturalists' Society having being duly proposed, was admitted into the Union.

The secretaries of the sections then announced the election of their officers as follows:—

B. Vertebrate Zoology.—Mr. Thos. Bunker, Goole, president; Mr. James Backhouse, jun., F.Z.S., M.B.O.U., York, and Mr. Edgar R. Waite, F.L.S., Leeds, hon. secretaries; all re-elected.

C. Conchology.—Rev. W. C. Hey, M.A., York, president (re-elected); Mr. John Emmet, F.L.S., Boston Spa (re-elected), and Mr. L. B. Ross, F.C.S., Driffield, hon. secretaries.

D. Entomology.—Mr. Dobrée reported that want of attendance at the meeting had prevented the election from taking place, whereupon it was moved and carried unanimously that the officers be re-elected as follows:—Mr. N. F. Dobrée, F.E.S., Beverley, president; Mr. W. E. Brady, Barnsley, and Mr. J. H. Rowntree, Scarborough, hon. secretaries.

E. Botany.—Mr. C. P. Hobkirk, F.L.S., Dewsbury, president; Mr. P. F. Lee, Dewsbury, and Mr. M. B. Slater, F.L.S., Malton, hon. secretaries; all re-elected.

F. Geology.—Rev. E. M. Cole, M.A., F.G.S., Wetwang, president; Mr. S. A. Adamson, F.G.S., Leeds, and Mr. S. Chadwick, F.G.S., Malton, hon. secretaries; all re-elected.

The members then adjourned to the Café Royal, Saville Street, where tea was provided.

The Annual Public Meeting was held at seven o'clock in the Lecture Theatre of the Royal Institution, the chair being occupied by the President, Mr. Henry E. Dresser, F.L.S., F.Z.S. The substance of the Annual Report and the Excursion-Programme for 1890 were announced to the meeting by the Rev. E. P. Knubley, M.A., M.B.O.U., after which the chair was vacated in favour of the Mayor of Hull (Ald. John Sherburn, M.B.), who called upon Mr. Dresser to deliver the annual Presidential Address, entitled 'A few remarks on Natural History, past and present, together with Notes on a recent Trip to Spain.' The President prefaced his remarks by an expression of the extreme gratification it afforded him to preside over a meeting of Yorkshire Naturalists, especially in the town of Hull, for, essentially a Yorkshireman (as not a drop of blood flows in his veins but what is pure Yorkshire) he was half a Hull man, and spent some of his earlier days in that town. He then proceeded to give a short sketch of the gradual growth of the Study of Natural History, and more especially of Ornithology, to the study of which he had from childhood devoted his spare time.

At the conclusion of the address a vote of thanks, proposed by Dr. Lambert and seconded by Dr. Walton, was unanimously passed to the President, as was also a cordial vote of thanks to the Hull Societies for their kind and hospitable reception.

A hearty vote of thanks, accorded to the Mayor of Hull, brought the proceedings to a close.—E.R.W.

SUPPLEMENTARY LIST OF MEMBERS.

CORRECTED TO OCTOBER 31st, 1890.

(The Members whose names are printed in heavy type in this and the previous list are those of Permanent Members of the General Committee. The Dates preceding names are those of election; Original Members, being those elected previous to 1883, are marked —).

1889 Adams, Lionel E., *B.A.*, *Treas. C.S.*, *Rose Hill*, *Penistone.*
1889 Alexander, R. G., *M.A.*, *M.D.*, *F.L.S.*, *Manor Row Chambers*, *Bradford.*
1889 Ashwell, Andrew Thomas, *Post-master*, *Malton.*
1889 Atkinson, Thomas, 7, *Normanby Terrace*, *Whitby.*
1890 Bacon, J. Cæsar, *Seafield*, *Santon*, *Isle of Man.*
1890 Barber, H. Jocelyn, *Brighouse.*
1890 Bell, James Lumsden, *M.D.*, *White Hall*, *Driffield.*
1890 Buchanan, John Hamilton, *M.D.*, *Sowerby*, *Thirsk.*
1890 **Carter, W. Lower,** *M.A.*, *F.G.S.*, *Briar Villas*, *Meanwood*, *Leeds.*
1889 Chadwick, G. W., *at Mr. W. Taylor's*, *Chemist*, *Saltburn-by-the-Sea.*
1890 Cooper, Wm., *A.M.Inst.C.E.*, *M.I.M.E.*, *M.I.N.A.*, 18, *Linnæus Street*, *Hull.*
1890 Corbett, Herbert H., *M.R.C.S.*, 19, *Hall Gate*, *Doncaster.*
1889 Dacre, Hubert, 5, *Park Grove*, *York.*
1889 Davis, J. Percy Avison, *Chevinedge*, *Halifax.*
1889 Davison, Richard, *Driffield.*
1890 Dickons, J. Norton, 12, *Oak Villas*, *Manningham*, *Bradford.*
1889 Downe, James, 21, *Rylett Crescent*, *Goldhawk Road*, *Hammersmith.*
1889 Edson, George, *Quarry Cottage*, *Middlecave Road*, *Malton.*
1890 Fawcett, George, *Keld*, *Swaledale*, *viâ Richmond*, *Yorks.*
1889 Fletcher, Charles H., 22, *South Street*, *Scarborough.*
1889 Fletcher, William, *Post Office*, *Pickering.*
1890 Foster, *Rev.* F. Barham, *B.A.*, *Heckmondwike.*
1890 Foster, John Machell, *Burgate House*, *Pickering.*
1889 Fountain, Joshua, *Ship Inn*, *Filey.*
1889 Fox-Thomas, *Rev.* Egbert, *Sneaton Castle*, *Whitby.*
1890 Frank, George, *Low Hall*, *Kirby Moorside*, *viâ York.*
1890 Hallimond, Henry T., 3, *Lune Street*, *Saltburn-by-the-Sea.*
1890 Hodgson, —, *Seedsman*, *Pickering.*
1889 Hodsman, George, 8, *Feversham Terrace*, *York.*
1889 Holtby, John, *Buck Hotel*, *Driffield.*
1890 Jackson, Andrew M., *Victoria Chambers*, *Hull.*
1889 Johnson, Henry, 2, *Queen Street*, *Barnsley.*
1890 Jones, A. Orlando, *M.D.*, *Cardigan Villa*, *Harrogate.*
1890 Jones, George Fowler, *Quarrybank*, *Malton.*
1889 King, John, *Grove Villa*, *Franklin Road*, *Harrogate.*
1889 Lambert, Abraham, 7, *York Terrace*, *Harrogate.*
1890 Last, Edwin Walter, *Mount Edgerton*, *Huddersfield.*
1890 LeTall, Benjamin Bower, *M.A.Lond.*, 20, *Bootham*, *York.*
1889 Lofthouse, J. H., 17, *Holmedale Terrace*, *Harrogate.*
1889 Lucy, Charles T., *York Union Bank*, *Pickering.*
1890 Marshall, J. J., *Market Weighton*, *R.S.O.*
1889 Mortimer, J. R., *Corn Merchant*, *Driffield.*
1890 Nassau, W. T. H., 2, *West Park Terrace*, *Anlaby Road*, *Hull.*
1889 Naylor, E., 48, *Market Street*, *Bradford.*
1890 Nicholls, A. E., 43, *Reginald Terrace*, *Leeds.*
1890 Nicholson, John, *Chapeltown*, *Pudsey.*
1889 Perkins, Frank, 22, *James Street*, *Harrogate.*
1890 Phillips, John H., 22, *Albemarle Crescent*, *Scarborough.*
1889 Pickard, Isaac, *North Park Road*, *Harrogate.*
1889 Place, James A., *Chemist*, *Pickering.*
1890 Platt, Owen, *Prospecton*, *Greenfield*, *Oldham.*
1890 Procter, John William, *Ashcroft*, *York.*

1890 Raine, Joseph, *Newbiggin, Richmond, Yorkshire.*
1890 Rhodes, James, 9, *Henry Street, Keighley.*
1890 Roberts, Walter, *St. Sepulchre Gate, Doncaster.*
1889 Rowntree, Allan, 33, *Westborough, Scarborough.*
1890 St. Quintin, W. H., J.P., *Scampston Hall, Rillington, York.*
1890 Scott, Frederick A., *Sutton, near Hull.*
1889 Sherwood, Eleazar, *M.D., F.R.Bot.S.Ed., Prospect Hill, Whitby.*
1890 Sparks, William, *Nafferton Road, Driffield.*
1890 Spencer, Thomas, *The Terrace, Richmond, Yorkshire.*
1890 Spiers, *Miss* Ada Maria, 221, *Rockingham Street, Sheffield.*
1890 Spiers, *Rev.* William, *M.A., F.R.M.S., F.G.S.*, 16, *Harley Street, Hull.*
1889 Stevenson, John, *Whitby.*
1889 Stewart, John T., 3, *Belle Vue Terrace, Whitby.*
1889 Stonehouse, Wm., 3, *Crescent Place, West Cliff, Whitby.*
1889 Suddaby, W. M., *Crown Hotel, Wheelgate, Malton.*
1889 Sundius, *Rev.* C. Smith, *M.A., Vicarage, Lund, Beverley.*
1890 Sutcliffe, J. Williams, 27, *West View, Hopwood Lane, Halifax.*
1889 Taylor, J. D., *Springfield, Halifax.*
1889 Taylor, Thomas, *Paddock House, Whitby.*
1890 Thomas, W. H., 10, *West Terrace, North Ormesby, Middlesbrough.*
1890 Thompson, M. Lawson, *Albion Terrace, Saltburn-by-the-Sea.*
1889 Trechmann, Chas. O., *Ph.D., F.G.S.*, 10, *Cliff Terrace, Hartlepool.*
1890 Veitch, W. Y., *M.D., Grange Road, Middlesbrough.*
1890 Waddington, Robert, 7, *Beverley Road, Driffield.*
1890 Walker, John Francis, *M.A., F.G.S., F.L.S., F.C.S., F.I.C., F.Z.S., etc.*, 45, *Bootham, York.*
1890 Waud, Henry, *The Gardens, Brinkburn, Darlington.*
1889 Wheldon, John Wm., *Burgate, Pickering.*
1890 Whitaker, J. A., *Craven Lodge, Halifax.*
1890 Wilson, H. J., *M.P., Osgathorpe Hills, Sheffield.*
1889 Wood, Richard, *M.D., Beverley Street, Driffield.*
1890 Woodd, C. Hampden R., *Roslyn, Hampstead, London, N.*
1890 Woodhead, T. W., *Birkby, Huddersfield.*
1890 Worswick, Richard Arthur, *Surveyor, Saltburn-by-the-Sea.*

LIFE MEMBER

By virtue of a Donation of Ten Pounds.

1890 Lilford, *Right Hon. Lord, F.L.S., etc., Lilford Hall, Oundle, Northamptonshire.*

LIFE MEMBERS

By virtue of a Donation of Five Guineas.

1890 Balme, E. B. Wheatley, *J.P., Cote Wall, Mirfield.*
1890 Buckton, Joshua, *West Lea, Meanwood, Leeds.*
1890 Carlisle, *Right Hon. Earl of, J.P., Castle Howard, York.*
1890 Charlesworth, John B., *J.P., Hatfield Hall, Wakefield.*
1890 Foljambe, Cecil G. Savile, *J.P., Cockglode, Ollerton, Newark.*
1890 Hirst, Ben, *J.P., Tamewater, Dobcross, near Oldham.*
— **Holgate, Benj.**, *F.G.S., Regent House, Grosvenor Road, Headingley.*
1890 Jones, R. Heywood, *J.P., Badsworth Hall, Pontefract.*
1890 Kitson, *Sir* James, *Bart., J.P., Gledhow Hall, Leeds.*
— **Knubley, Rev. E. P.**, *M.A., M.B.O.U., Staveley Rectory, via Leeds.*
1890 Lees, Edward B., *J.P., Kelbarrow, Grasmere, Westmorland.*
1890 Marshall, Arthur, *Hallsteads, Penrith.*
1890 Newton, *Rev. Canon* Horace, *The Vicarage, Driffield.*
1890 Oxley, Henry, *Spenfield, Weetwood, Leeds.*
1890 Wright, C. B. E., *J.P., Bolton Hall, Clitheroe.*

The Secretaries of the Union will be glad to be informed of any changes of address or corrections in the above list.

LEEDS:

PRINTED BY M^CCORQUODALE & CO. LIMITED.

ANNUAL REPORT FOR 1890

(NOVEMBER 1890),

AND

LIST OF MEMBERS,

15th OCTOBER, 1891.

LEEDS:

PRINTED BY MCCORQUODALE & CO. LIMITED.

YORKSHIRE NATURALISTS' UNION.

29th ANNUAL REPORT, for 1890.

THE Executive, in presenting the 29th Annual Report and Statement of Accounts, have to congratulate the members upon a year of steady and continued progress and of satisfactory work, whether as regards the value of the Union's publications, the interest maintained in its excursions, or the amount of work done by the various Committees appointed for special research.

The Meetings which have been held during the year have been five in number, one for each division of the county, the places and dates having been as follows:—

May 26th, Whit-Monday, Driffield for Lowthorpe.
June 14th, Saturday, Dewsbury for Bretton Park.
July 8th, Tuesday, Kildale-in-Cleveland.
Aug. 2nd to 4th, Saturday to Bank Holiday Monday, Upper Swaledale (Gunnerside, Kisdon, and Keld).
Sept. 11th, Thursday, Malham and Gordale (in connection with the meeting of the British Association in Leeds).

For each of these meetings the usual descriptive circular, which is so conducive to the convenience of members and associates undertaking the day's explorations, was issued, and at all the meetings good results were achieved.

The opening meeting, fixed for the investigation of the picturesque little valley down which flows the famous trout stream, with Driffield as the actual place of meeting, was the means of introducing members to a district of the East Riding which the Union has never before visited. On this occasion the Union met with the utmost kindness on the part of one of its members, Mr. W. H. St. Quintin, over whose property the route lay. At the meeting the chair was occupied by Mr. N. F. Dobrée, F.E.S., President of the Entomological Section, and before leaving Driffield a visit was paid to Mr. Mortimer's well-arranged and most interesting museum.

The second excursion was held in June, at Dewsbury, and the districts visited were Bretton Park, Coxley Valley, and Bullcliffe Wood. The arrangements were admirably made by Messrs. P. F. Lee and Chas. P. Hobkirk, F.L.S., the latter of whom, in his capacity of President of the Botanical Section, presided at the meeting. Some interesting observations were made during the day, and the only regret is that, in a place so conveniently accessible to the great body of members and associates, the attendance was not more than an average one.

The third meeting was arranged for July, for the investigation of Kildale, a picturesque and sequestered little valley in the Cleveland Hills. Thanks to the local knowledge and excellent arrangements made by the Middlesbrough members, the excursion was more than usually productive of good results, especially to the conchologists, entomologists, and botanists, the investigations of the two latter sections being instrumental in discovering a lepidopterous insect new to the county list and a plant additional to the North Riding flora. The meeting was for convenience held at Middlesbrough, the chair being occupied by Dr. W. Y. Veitch, the President of the Cleveland Naturalists' Field Club.

The August Bank Holiday excursion was devoted to Upper Swaledale, and the district being much too inaccessible for a single day's excursion, the observations were extended over three days, as was done in Teesdale in the preceding year. There was a fair attendance of members, and the Union was particularly fortunate in having the presence of Mr. J. G. Goodchild, F.G.S., by whom the whole of the district had been geologically surveyed. His able guidance and genial company made the excursion one that will be recalled with pleasure by all who joined in it. The chair of the meeting, which was held at Muker, was occupied by the Rev. R. V. Taylor, B.A., the Vicar of Melbecks.

The closing meeting of the year was one arranged in connection with the Leeds meeting of the British Association, and by the kindness of an old member of the Union, Mr. Walter Morrison, M.P., was held at Malham. The meeting was a successful one, and was well attended, both by members of the British Association and of the Union. Mr. C. P. Hobkirk presided at the meeting, which was very short, the usual sectional reports being omitted.

On all these occasions the Union has been indebted to the unvarying kindness with which Yorkshire landowners facilitate scientific research on their estates, and the opportunities granted by the various railway companies whose lines run through Yorkshire contribute their share to promoting the success of the Union's investigations.

The Societies which constitute the Union are now thirty-nine in number, as against forty last year. Two small societies, numbering eighteen members between them, have ceased to exist, viz., the Middlesbrough Junior Naturalists' Club, whose members now join in the work of the Cleveland Club, and the Practical Naturalists' Society, whilst another Society of thirty members, the Leeds Y.M.C.A. Naturalists' Club, withdrew from the Union at the beginning of the year. On the other hand, two new Societies have been

admitted—the Scarborough Naturalists' Society with thirty-seven members, and the Ravensthorpe Naturalists' Society with 124.

The statistics which the Secretaries of the various Societies have again been kind enough to furnish, show a slight increase in the number of Associates, the aggregate membership of the thirty-nine Societies now amounting to 2,580, an increase of sixty-three. Adding to this the number of direct members, the total numerical strength of the Union is 3,010.

The Membership now stands at 430, an increase of twenty on the previous year. During the year, 43 new members have been elected.

The Union has been unfortunate in losing by death several good supporters in Messrs. Jas. Backhouse, F.L.S., Wm. Aldam, D.L., J.P., Edward Hailstone, F.S.A., John Grassham, Walter W. Booth, Francis H. Potter, and E. B. Wrigglesworth, the latter of whom was at one time a Secretary of the Entomological Section. The most serious loss has been that of a member of the Executive Committee in Mr. S. A. Adamson, F.G.S., who had for several years been the life and soul of the Geological Section and a most energetic member of the committees concerned with geological research.

The Financial Position of the Union has been a subject of some anxiety to the Executive during the year, as the very heavy loss which the Union sustained in the matter of the publication of the West Yorkshire Flora and difficulty in recovering some of the arrears of subscriptions, have much embarrassed the Treasurer in paying off the Union's liabilities. The number of copies of the Flora which are left in stock is quite sufficient to clear off the liability incurred for its publication, and members could do the Union good service by providing themselves with the work; but so long as the unsold copies remain in hand, the Union's work in publishing Transactions will be somewhat restricted.

Much credit is due to the various members who act as local Treasurers for the service which they render to the Union, many of them keeping the subscriptions in their district regularly and systematically collected, and thereby avoiding the accumulation of the arrears which in certain instances form so serious an inconvenience.

It is satisfactory to note the increasing number of members who avail themselves of the convenient method of instructing their bankers to pay the subscription on its falling due.

The Publications of the Union have been as in former years.

The Transactions.—Part 14 was issued in September of this year, and was devoted to a Report by Mr. Robert Kidston, F.R.S.E

on the Carboniferous Flora of Yorkshire, being the first of the reports prepared for the Union's Fossil Flora Committee. The second of these reports is in course of preparation by Mr. Wm. Cash, and will deal with the Flora of the Halifax Hard Bed.

Part 15, which is devoted to the continuation of Mr. J. Gilbert Baker's 'North Yorkshire,' is now ready for issue to the members, and will very shortly be sent out.

All the sheets intended for inclusion in Part 16 are printed or in the printer's hands, and it is proposed to issue it about the middle or end of January next.

When this has been issued, the arrears in the publication of the Transactions, which have for some years been a source of anxious consideration to the Executive, will have been overcome, and it will afterwards be practicable to issue each part during the course of the year for which it is due.

The Library continues to increase by means of donations and exchanges, and is suitably accommodated in book-cases at the Leeds Mechanics' Institute.

The Sections of the Union have carefully carried on their work during the year, and it is to their efficient management that much of the success which attends the excursions has been attributable.

Committees of Research.—This important feature of the Union's work has been further developed during the year by the appointment at the last annual meeting of three additional Committees, all working in conjunction with similar ones of the British Association.

Of these new Committees, the one for collecting and recording Geological Photographs has worked with remarkable success, as was evidenced by their having contributed the larger portion of the excellent show of geological photographs which was exhibited at this year's meeting of the British Association.

The Committee for collecting information as to the Disappearance of Plants from their old habitat, has also carried on its work with success, and contributed a larger number of facts to the report which Prof. Hillhouse gave to the British Association this year. The detailed Yorkshire report, compiled by Messrs. C. P. Hobkirk, F.L.S., and P. F. Lee, has been published in 'The Naturalist.'

The Committee appointed for the investigation of the Cryptogamic Flora and Invertebrate Fauna of the Freshwaters of Yorkshire has accumulated a number of interesting facts, but has been unable to frame a report, from inability to obtain from the British Association Committee copies of the necessary schedules. This

being mentioned at the British Association Meeting, the Yorkshire Committee was encouraged to frame a schedule of its own, and it is therefore to be hoped that in another year it will be in a favourable position for reporting good work in a most fascinating field of study.

Of the Committees of older standing, the Yorkshire Boulder Committee, which has during the past three years worked so energetically and successfully, has suffered most seriously by the decease of its secretary, Mr. S. A. Adamson, but has nevertheless been able to report a considerable number of erratics, and to again occupy a prominent part of the report on Erratics given to the British Association.

The Yorkshire Fossil Flora Committee has also continued its investigations, the first portion of which is already in print, and the second instalment, which Mr. W. Cash, F.L.S., has in preparation, will include some observations of considerable interest bearing upon the flora of the Halifax Hard Bed.

The Yorkshire Marine Zoology Committee has no report to make, not having been able to prosecute active operations, probably owing in part to the Union not having had a coast excursion.

The Yorkshire Coast Erosion Committee has done something in the direction of recording facts bearing upon its subject, but is not prepared as yet to make any detailed report.

British Association.—The Union has again been appointed one of the Corresponding Societies of the Association, and was represented at the meeting held in Leeds this year by the Rev. E. P. Knubley, M.A., and Messrs. C. P. Hobkirk, F.L.S., and Wm. Cash, F.L.S.

Life Membership.—Your Executive having considered that it would materially benefit the Union to enrol a number of Life Members, the qualification being a donation not less in amount than Five Guineas, ventured to address themselves to a number of noblemen and gentlemen of the county or connected with it, and are pleased that the response has been gratifying. Several Life Members have now been enrolled, and the Executive hope still further to increase the number.

The Presidency for next year (1891) has been offered to and accepted by an old and distinguished member of the Union—Prof. A. H. Green, M.A., F.R.S., of the University of Oxford.

In conclusion, your Executive have to place on record their sense of gratitude to the Lord Bishop of Wakefield for the honour which he has conferred upon the Union by his tenure of the presidency for the year which has now come to a close.

July 1891.

YORKSHIRE NATURALISTS' UNION.

ANNUAL MEETING AT HALIFAX.

The 29th Annual Meeting of the Union was held at Halifax on the 18th November, 1890. Through the kindness of the Halifax Literary and Philosophical Society, the Lecture Theatre at the Museum, Harrison Road, was placed at the disposal of the Union for the purpose of holding its various meetings. The Ackroyd Museum and Art Gallery, the Public Library at Belle Vue, and the Museum of the Literary and Philosophical Society were very generously thrown open throughout the day to members and associates of the Union. It was chiefly to Mr. J. W. Davis, F.G.S., Mayor of Halifax, and other local members of the Union, that the success of the meeting was due.

At three o'clock the various sections met in the rooms of the Museum for the purpose of electing their officers for the ensuing year, and for the consideration of their annual reports.

An hour later the General Committee met in the Lecture Theatre of the same institution. Fifteen societies were officially represented by delegates, and other six were unofficially represented by permanent members of the General Committee. The attendance also included one ex-President (Rev. W. Fowler, M.A.), all the Honorary Secretaries (Mr. Wm. Denison Roebuck, F.L.S., Rev. E. P. Knubley, M.A., and Mr. Edgar R. Waite, F.L.S.), six members of the Executive, one President and four Secretaries of Sections, three of the local Treasurers, and nine other permanent members of the General Committee, the total attendance being forty-seven.

The chair was occupied by the Chairman of the Executive (Mr. C. P. Hobkirk, F.L.S.). The minutes of the previous annual meeting were taken as read. The 29th Annual Report (as printed on p. 219) was read by the Rev. E. P. Knubley, M.A., one of the Hon. Secretaries, and on the motion of the Chairman, seconded by Mr. J. W. Davis, F.G.S., F.L.S., was unanimously adopted.

The Secretary then read the recommendation of the Executive that the excursions for 1891 be fixed for the following places, the selection of dates to be left for decision by the new Executive :—

South-East Yorkshire	...	Sledmere.
North-East ,,	...	Hayburn Wyke.
North-West ,,	...	Leckby Carr.
Mid-West ,,	...	Gisburn.
South-West ,,	...	Conisborough and Edlington Wood.

Some discussion took place with regard to the Mid-West Yorkshire excursion, and ultimately Grassington was substituted for Gisburn,

on the motion of Mr. J. W. Davis, F.G.S., F.L.S., seconded by Mr. J. H. Howarth. The amended programme was then adopted, on the motion of the Chairman, seconded by Mr. G. T. Porritt, F.L.S., F.E.S.

The annual meeting for 1891 was the next subject for consideration, and a letter was read from the Scarborough Field Naturalists' Society cordially inviting the Union to hold the Meeting at Scarborough. The invitation was unanimously accepted, on the motion of the Chairman, seconded by Mr. J. J. Stead.

Proceeding to the election of officers, the Chairman announced, as stated in the concluding paragraph of the Annual Report, that the Presidency for the ensuing year had been offered to and accepted by one who had formerly been a familiar figure on the Union's excursions—Professor A. H. Green, M.A., F.R.S., holding the Geological Chair at the University of Oxford, and late of the Yorkshire College, Leeds.

On the motion of the Chairman, Mr. Wm. Denison Roebuck, F.L.S., and the Rev. E. P. Knubley, M.A., were re-elected Honorary Secretaries of the Union. It was stated that a letter had been received from Mr. Percy H. Grimshaw, in which he mentioned that owing to increased pressure of private work, he was compelled to retire from the office of Hon. Assistant Secretary, whereupon the Chairman announced that the Executive recommended that a third General Secretary of the Union should be appointed in the person of Mr. Edgar R. Waite, F.L.S.; this was unanimously carried on the motion of Messrs. J. W. Davis, F.G.S., F.L.S., and G. T. Porritt, F.L.S., F.E.S. A letter was read from Mr. Charles Brownridge, stating that his health compelled him to ask to be allowed to retire from the post of Hon. Librarian. The matter was referred to the Executive for consideration.

On the motion of Mr. Washington Teasdale, seconded by Mr. J. A. E. Stuart, the following nine retiring members of the Executive were re-elected:—Rev. W. Fowler, M.A., Liversedge; Messrs. J. W. Davis, F.G.S., F.L.S., Halifax; William Cash, F.L.S., Halifax; C. P. Hobkirk, F.L.S., Dewsbury; John Emmet, F.L.S., Boston Spa; Benj. Holgate, F.G.S., Leeds; H. T. Soppitt, Bradford; J. J. Stead, Heckmondwike; and M. B. Slater, F.L.S., Malton. Mr Charles Brownridge, F.G.S., was elected in place of the late Saml. A. Adamson.

Mr. C. D. Hardcastle was re-elected one of the Auditors, and the election of a second Auditor was left to the Executive, Mr. J. E. Bedford, F.G.S., having resigned.

All the retiring Hon. Local Treasurers were re-elected, as follows:—Messrs. W. E. Brady, Barnsley; J. D. Butterell, Beverley; H. Speight, Bradford; J. A. E. Stuart, Dewsbury; Geo. Winter, Doncaster; L. B. Ross, F.C.S., Driffield; T. Bunker, Goole; W. Cash, F.L.S., Halifax; Riley Fortune, F.Z.S., Harrogate; John Stears, Hull; Edgar R. Waite, F.L.S., Leeds; M. B. Slater, F.L.S., Malton; T. F. Ward, Middlesbrough; Wm. Fletcher, Pickering; Thos. H. Nelson, M.B.O.U., Redcar; Rev. R. A. Summerfield, B.A., Ripon; Richard Barnes, Saltburn; J. H. Rowntree, Scarborough; Hugh Richardson, B.A., Sedbergh; W. N. Cheesman, Selby; A. T. Watson, Sheffield; J. J. Stead, Spen Valley; Geo. Parkin, Wakefield; Thos. Newbitt, Whitby; G. C. Dennis, York; and Mr. J. J. Howarth was elected to the vacancy at Skipton.

On the proposition of Mr. Lionel E. Adams, seconded by Mr. G. T. Porritt, F.L.S., F.E.S., all the Committees of Research were re-appointed, as follows:

The Yorkshire Boulder Committee.—Prof. L. C. Miall, F.L.S., F.G.S. (chairman); Messrs. C. D. Hardcastle, Leeds (vice-chairman); Samuel Chadwick, F.G.S., Malton (hon. secretary); J. E. Bedford, F.G.S., C. Brownridge, F.G.S., W. Lower Carter, M.A., F.G.S., Leeds; Rev. E. Maule Cole, M.A., Wetwang; J. W. Davis, F.G.S., F.L.S., Halifax; Prof. A. H. Green, M.A., F.R.S., Oxford; Wm. Gregson, Baldersby; B. Holgate, F.G.S., Leeds; Wm. Horne, F.G.S., Leyburn; Robert Law, F.G.S., James Spencer, Halifax; Thos. Tate, F.G.S., Leeds; J. W. Woodall, M.A., F.G.S., Scarborough; J. R. Mortimer, Driffield; and R. Wood, M.D., Driffield; with the Rev. H. W. Crosskey, M.A., as an honorary member.

The Yorkshire Marine Zoology Committee.—Dr. H. C. Sorby, LL.D., F.R.S., Sheffield (chairman); Messrs. J. Percy A. Davis, Halifax (hon. secretary); G. Brook, F.L.S., Edinburgh; J. D. Butterell, Beverley; W. Eagle Clarke, F.L.S., Edinburgh; John Cordeaux, M.B.O.U., Great Cotes; W. Cash, F.L.S., Halifax; Rev. W. C. Hey, M.A., York; Baker Hudson, Redcar; T. H. Nelson, Redcar; O. T. Olsen, F.L.S., Grimsby; Rev. H. Smith, M.A., Redcar; J. W. Woodall, M.A., F.G.S., Scarborough; with George Massee, F.R.M.S., Kew, as Botanical Referee.

The Yorkshire Fossil Flora Committee.—Prof. W. C. Williamson, LL.D., F.R.S., Manchester (chairman); James W. Davis, F.L.S., F.G.S., F.S.A., Halifax (vice-chairman); William Cash, F.G.S., F.L.S., F.R.M.S., 38, Elmfield Terrace, Halifax (hon. secretary); Messrs. Thos. Hick, B.A., B.Sc., Manchester; Benj. Holgate, F.G.S., Leeds; Robert Kidston, F.G.S., F.R.S.E., Stirling; Robert Law, F.G.S., Halifax; Prof. L. C. Miall, F.L.S., F.G.S.,

Leeds; James Spencer, Halifax; John Stubbins, F.G.S., F.R.M.S., Leeds; and William West, F.L.S., Bradford.

Yorkshire Coast Erosion Committee. — Mr. J. W. Woodall, F.G.S. Scarborough (chairman); Rev. E. Maule Cole, M.A., F.G.S., Wetwang (hon. secretary); Rev. H. E. Maddock, M.A., Patrington; Mr. J. C. I'Anson, F.S.A., F.G.S., Saltburn-by-the-Sea; and Dr. F. Fielder Walton, F.G.S., Hull.

Yorkshire Micro-Zoology and Micro-Botany Committee.—Dr. H. C. Sorby, LL.D., F.R.S., Sheffield (chairman); Messrs. J. M. Kirk, F.R.M.S., Doncaster (hon. sec.); C. B. Crawshaw, Dewsbury; Charles Crossland, Halifax; Prof. Alfred Denny, F.L.S., Sheffield; Rev. W. E. Handcock, M.A., Knaresborough; Chas. P. Hobkirk, F.L.S., Dewsbury; M. H. Stiles, Doncaster; and William West, F.L.S., Bradford.

Disappearance of Native Plants Committee.—Messrs Charles P. Hobkirk, F.L.S., Dewsbury (chairman); P. Fox Lee, Dewsbury (hon. secretary); R. Barnes, Saltburn-by-the-Sea; Edward Birks, Sheffield; John Emmet, F.L.S., Boston Spa; John H. Phillips, Scarborough; Rev. W. A. Shuffrey, M.A., Arncliffe; Matthew B. Slater, F.L.S., Malton; Rev. Wm. Thompson, M.A., Sedbergh; and T. W. Woodhead, Huddersfield.

Geological Photographs Committee.—Messrs. James W. Davis, F.L.S., F.G.S., F.S.A., Halifax (chairman); James E. Bedford, F.G.S., Cardigan Villas, Headingley (hon. secretary); Godfrey Bingley, Leeds; Frederick W. Branson, F.I.C., F.C.S., Leeds; Rev. E. Maule Cole, M.A., F.G.S., Wetwang; George Fowler Jones, Malton; A. E. Nichols, A.M.Inst.C.E., Leeds; and F. Fielder Walton, F.G.S., Hull.

Voting papers for the election of 10 new Permanent Members of the General Committee had been sent to all members of the Union, and 32 of them had been returned, with the result that the following 10 members had been elected, viz.:—Rev. F. Addison, M.A., Thirsk; Messrs. Charles Crossland, Halifax; Elijah Howarth, F.R.A.S., Sheffield; Robt. Law, F.G.S., Halifax; Thos. Newbitt, Whitby; George Parkin, Wakefield; Rev. H. A. Powys, M.A., Meanwood; A. T. Watson, Sheffield; John Thrippleton, Leeds; and George Winter, Doncaster.

The following gentlemen were elected Life Members of the Union:—Rt. Hon. Lord Lilford, Oundle, Northants; Messrs. E. B. Wheatley Balme, Mirfield; Joshua Buckton, Leeds; Rt. Hon. Earl of Carlisle; Messrs. John B. Charlesworth, J.P.; Cecil G. S. Foljambe, J.P.; Ben. Hirst, J.P.; R. Heywood Jones, J.P.; Sir James Kitson, Bart., J.P., Leeds; Edward B. Lees, J.P.;

Arthur Marshall; Rev. Canon H. Newton; Henry Oxley, Leeds; C. B. E. Wright, J.P.; Jas. S. Cooke, F.R.A.S., J.P.; Col. John E. Champney, J.P.

The Ordinary Members elected were:—J. Edmondson, Halifax; George Fawcett, Keld; Edward Gledhill, Halifax; G. F. Harding, Halifax; Charles H. Hutchinson, Barnsley; W. B. Hutchinson, Liversedge; Tom Jubb, Halifax; Charles Middleton, Halifax; W. H. Newhouse, Brighouse; Owen Platt, Oldham; A. W. Reith, M.A., Halifax; Albert Seed, Halifax; John Shillito, Halifax; John W. Stather, Hull; Charles H. Thackrah, Halifax; James A. Toothill, Halifax; H. Whitley, B.A., Halifax; Henry J. Wilson, M.P., Sheffield; David Woodhead, Halifax; C. H. Worsnop, Halifax.

The sectional officers were next called upon to announce the names of the officers elected for 1891, as follows:

B. Vertebrate Zoology.—Mr. Edgar R. Waite, F.L.S., reported that all the officers of the past year had retired, and the following had been elected in their stead:—President, James Backhouse, F.Z.S., M.B.O.U., Harrogate; Secretaries, Riley Fortune, F.Z.S., Harrogate; Thos. H. Nelson, M.B.O.U., Redcar.

C. Conchology.—Mr. John Emmet, F.L.S., stated that all the old officers had been re-elected, viz.:—President, Rev. W. C. Hey, M.A., York; Secretaries, John Emmet, F.L.S., Boston Spa; Lewis B. Ross, F.C.S., Driffield.

D. Entomology.—Mr. G. T. Porritt, F.L.S., reported that the following appointments had been made:—President, G. T. Porritt, F.L.S.; Secretaries, Jas. H. Rowntree, York (re-elected); A. E. Hall, F.E.S., Sheffield.

E. Botany.—Mr. Charles P. Hobkirk, F.L.S., presented the report of the section, announcing that the officers had been elected as follows:—President, Charles P. Hobkirk, F.L.S., Dewsbury (re-elected); Secretaries, M. B. Slater, F.L.S., Malton (re-elected); J. A. Erskine Stuart, Heckmondwike.

F. Geology.—Mr. Samuel Chadwick, F.G.S., reported that the following officers had been elected:—President, C. D. Hardcastle, Leeds; Secretaries, W. Lower Carter, M.A., F.G.S., Leeds (re-elected); Samuel Chadwick, F.G.S., Malton (re-elected).

This concluded the business of the General Committee, whereupon Members adjourned to the White Swan Hotel where tea was provided.

The Annual Public Meeting was held at seven o'clock in the Lecture Theatre of the Museum of the Halifax Literary and Philosophical Society. The chair was taken by Mr. James W. Davis,

F.G.S., F.L.S., F.S.A., Mayor of Halifax, and an old and prominent member of the Union.

The minutes of the previous annual meeting having been printed and circulated were taken as read, as was also the Annual Report which appears on pages 219-223 of 'The Naturalist.'

The excursion-programme for 1891 having been announced to the meeting, the Chairman called upon the Right Rev. W. W. How, D.D., Lord Bishop of Wakefield, to deliver the Annual Presidential Address, entitled 'The Study of Natural Science.'

The Bishop, who had a cordial reception, said he had not for years been able to do anything in scientific studies, except of a most casual and superficial character. But his interest in scientific matters could never, he thought, decline. He thought they had learnt in these latter days that a patient collection of facts was a key which opened the gate of all new avenues of discovery, and of all enlargements of their area of knowledge. Of course very few single minds could combine powers of minute observation, of delicate comparison, of intuitive recognition of the true bearing of phenomena, with a large grasp of general principles, and a profound skill in fitting all details into the great theories which characterised a Darwin. Darwin seemed to combine all the powers which could contribute to the advancement of science. He was a thinker, and a collector of facts—he was, indeed, he supposed, one of the most splendidly-equipped minds for the prosecution of natural science which one could conceive of. But though few could combine all those various powers, a very great number could contribute something to the advancement of natural science. As an illustration of this point, the Bishop mentioned the splendid astronomical discoveries at the beginning of the seventeenth century. Tycho in Denmark, Kepler in Germany, and Galileo in Italy, working each in his own way to accomplish results which were to shake the world. No one of these could have won the splendid triumphs which were achieved without the other two. He urged the members of this Union to learn the habit of accurate observation, and to record carefully what they observed. Take, for example, botany—say a plant new to the region where it was found, such as the *Arenaria gothica*, discovered at Ribblehead last year. This meant not only an interesting find, but a contribution to far larger fields of inquiry, such as the distribution of the flora throughout the world, the modes and causes of that distribution, the changes in the surface of the earth, and the like. So, whatever branch of science they undertook, let them gather facts, be accurate, and record carefully. But as a Bishop, with a charge of the

highest interest laid upon him, he could not be content to deal only with the purely scientific aspect of this question. He knew that some said that science and faith occupied two distinct spheres which never touched. He never could hold that. They did touch. They overlapped, and they intersected. Of course, each had a region of its own untouched by the other. But it was foolish to say there was no point of contact. Take such things as the antiquity of man, the history of the Creation, the universality of the Deluge, the history of the sun and moon standing still—these were instances of how the two areas intersected. Well, he had no fears whatever from a patient, honest, candid, reverent study of Nature. God's library did not consist of one volume alone. There was the book of nature and the book of conscience, no less than the book of the Revealed Word; and if God was the author of these books, he did not think they could really contradict one another. If they did seem to do, we might be reading wrongly the one volume or the other. It had been so before, it might be so now. And if there was anything in the past history of the Church more humiliating than another—he supposed moral corruption was, but next to that—it was the fulminations of the Church against physical science. What a sad picture is that of Galileo, with his lucid insight and his firm grasp of the Copernican system! Who could help almost weeping as one reads of the aged philosopher made by the Inquisition to go down on his knees, and, with his hand on the Bible, to swear that all he taught was a tissue of lies? Which really was the more likely to lead to infidelity—the light of the sage or the darkness of the Church? Well, they had seen something like it in later times; in reference to Geology, for instance, and the story of the days of Creation in Genesis. Again, they had Evolution, and the same scare had to some extent been created in these later days. Yet he thought that the higher Christian philosophy, now more and more recognising the doctrine of the immanence of the Creator in all creation, could accept the doctrine of Evolution without fear. He did not want to assume that everything had been definitely and conclusively proved, but he thought they need not be in the least afraid if it should be conclusively proved; and he supposed they were advancing every day towards the acceptance of that truth as a great fact in scientific discovery. But, if proved, what then? Why, then what he would say was that they had been taught what was God's method of creating. Surely the creating by successive stages of advance was not less wonderful, and gave one no less idea of the power and wisdom of the Creator than the creating by an enormous number

of separate and disconnected acts. If they traced a few links farther back of cause and effect, they must at last come to the point where the last link was held by an invisible Hand.

Following the delivery of the address, a hearty vote of thanks was accorded to the President for his services during the past year, on the motion of Mr. Charles P. Hobkirk, F.L.S., seconded by Mr. Wm. Cash, F.L.S., and supported by the Ven. Archdeacon Brooke.

On the motion of the President, seconded by the Rev. E. P. Knubley, M.A., a similar vote was passed to the Mayor, for his services in the chair. A vote of thanks to the Council of the Halifax Literary and Philosophical Society for kindly allowing the Union the use of their Museum for the various meetings terminated the proceedings.—E.R.W.

LIST OF MEMBERS AND SOCIETIES.

CORRECTED TO OCTOBER 15th, 1891.

(The Members whose names are printed in heavy type are those of **Permanent Members of the General Committee.** The Dates preceding names are those of election; Original Members, being those elected previous to 1883, are marked —; those to whom **L.** is prefixed are Life Members, by virtue of a donation of not less than five guineas; and those to whom **H.L.** is prefixed are Honorary Life Members.

1888 ... Abram, J. W., *Foston, viâ Hull.*
1887 ... **Ackworth School Natural History Society.**
1889 ... Adams, Lionel E., *B.A., Treas. C.S., Rose Hill, Penistone.*
— ... **Addison,** *Rev.* **Frederick,** *M.A., Sowerby, Thirsk.*
1886 ... Addyman, James W., *B.A. Lond.*, 15 *East Parade, Leeds.*
1889 ... Alexander, R. G., *M.A., M.D., F.L.S., Manor Row Chambers, Bradford.*
1886 ... Anne, *Captain* Edward, *J.P., Hardriding House, Bardon Mill, Carlisle.*
1889 ... Ashwell, Andrew Thomas, *Post-master, Malton.*
1889 ... Atkinson, Thomas, 7, *Normanby Terrace, Whitby.*
1883 ... **Backhouse, James,** *F.Z.S., M.B.O.U., Renoso, Victoria Avenue, Harrogate.*
1890 ... Bacon, J. Cæsar, *Seafield, Santon, Isle of Man.*
— ... **Bairstow, Samuel Denton,** *F.L.S.*, 120, *Main Street, Port Elizabeth, Cape Colony.*
— **H.L.** **Baker, John Gilbert,** *F.R.S., F.L.S., The Royal Herbarium, Kew* (*Ex-President*).
1890 **L.** Balme, E. B. Wheatley, *J.P., Cote Wall, Mirfield, Normanton.*
1890 ... Barber, H. Jocelyn, *Brighouse.*
1888 ... **Barnes, Richard,** *The Gardens, Saltburn-by-the-Sea.*
— ... Barnes-Lawrence, *Rev. Canon* H. F., *M.A., C.M.Z.S., Birkin Rectory, Ferrybridge.*
— ... **Barnsley Naturalists' Society.**
— ... Barran, John, *M.P., Chapel-Allerton Hall, Leeds.*
1889 ... Bayford, E. G., 24, *Cambridge Street, Doncaster.*
— ... Beaumont, Alfred, *F.E.S.*, 153, *Hither Green Lane, Lewisham, London, S.E.*
— ... Bedford, James, *Sycamore Lodge, Woodhouse, Leeds.*
— ... **Bedford, James E.,** *F.G.S.*, 9, *Cardigan Road, Headingley, Leeds.*
1890 ... Bell, James Lumsden, *M.D., White Hall, Driffield.*
1884 ... **Bennett, Samuel H.,** *Boston Grove, Rotherham.*
1883 ... Bethell, William, *J.P., D.L., Rise Park, Hull.*
— ... Bewlay, Frederick, 6, *Vine Street, York.*
1885 ... Bidwell, Edward, *M.B.O.U., Fonnereau House. Twickenham, Middlesex.*
1888 ... Bilbrough, James Wm., *Wharfecote, Ben Rhydding, viâ Leeds.*
1888 ... Bilbrough, Mrs. J. W., *Wharfecote, Ben Rhydding, viâ Leeds.*
1885 ... **Bingley, Godfrey,** *Ash Lea, Cardigan Road, Headingley, Leeds.*
— ... Birchall, Edward, 18, *Moorland Road, Leeds.*
1884 ... **Birks, Edward,** *Birchcliffe, Broomhall Park, Sheffield.*
— ... **Birks, Thomas, jun.,** 25, *High Park Street, Toxteth Park, Liverpool.*
— ... Blakeley, John Wesley, *Ramsden Street, Littletown, Liversedge, viâ Normanton.*
— ... Bothamley, Charles H., *F.I.C., F.C.S., The Yorkshire College, and Hyde Park Villas, Leeds.*
— ... Bould, Charles H., 138, *Halifax Old Road, Huddersfield.*
— ... **Boyes, Frederick,** *Yorkshire Banking Company, Beverley.*
— ... **Bradford Naturalists' and Microscopical Society.**
— ... **Bradford Scientific Association.**
1884 ... **Brady, William E.,** 1, *Queen Street, Barnsley.*
— ... **Braim, John,** *Hungate, Pickering, Yorkshire.*
1885 ... Braithwaite, Wm. D., *Ackworth School, viâ Pontefract.*
1885 ... Branson, Frederick W., *F.I.C., F.C.S.*, 24, *Mount Preston, Leeds.*
— ... Brigg, John, *J.P., F.G.S., Kildwick Hall, viâ Leeds.*

1884 ... **Brittain, Frederick,** *Melbourne Avenue, Sheffield.*
— ... Broadhead, John, *Calverley House, Altofts, Normanton.*
1885 ... Broadhead, Seth, 30, *Shambles Street, Barnsley.*
1887 ... Bromley, John H., *Wortley Lodge, New Wortley, Leeds.*
— ... **Brook, George,** *F.L.S., F.R.M.S., etc., Lecturer on Embryology in the University, Edinburgh.*
— ... **Brooke, Edward, jun.,** *F.G.S., Oakley House, Edgerton, Huddersfield.*
1885 ... Brooke, John Arthur, *J.P., Fenay Hall, Huddersfield.*
1887 ... Brooke, *Ven. Archdeacon* J. Ingham, *M.A., The Vicarage, Halifax.*
1886 ... **Brownridge, Chas.,** *Assoc.M.I.C.E., F.G.S., 256, Burley Mount, Leeds.*
— ... Brunton, George, *Hillary Mount,* 169, *Woodhouse Lane, Leeds.*
1890 ... Buchanan, John Hamilton, *M.D., Sowerby, Thirsk.*
1890 L. Buckton, Joshua, *West Lea, Meanwood, Leeds.*
— ... **Bunker, Thomas,** 9, *East Parade, Goole.*
1891 ... Burton, J. J., *Hambleton House, Nunthorpe, R.S.O., York.*
— ... **Butterell, J. Darker,** *M.C.S.,* 4, *Willow Grove, Westwood, Beverley.*
— ... Butterfield, J. A., *B.Sc.,* 110, *Lewisham Road, London, S.E.*
— ... **Butterfield, E. P. P.,** *Wilsden, near Bingley.*
1890 L. Carlisle, *Right Hon. Earl of, J.P., Castle Howard, York.*
1891 ... Carnell, Thomas, 6, *New Road, Halifax.*
1891 L. Carpenter, Hon. Mrs. [Beatrice], *Kiplin, Northallerton.*
— ... **Carter, James,** *M.B.O.U., Burton House, Masham, viâ Bedale.*
— ... **Carter, J. W.,** 25, *Glenholme Road, Whetley Lane, Bradford.*
1890 ... **Carter, W. Lower,** *M.A., F.G.S., Briar Villas, Meanwood, Leeds.*
1887 ... **Cash, William,** *F.L.S., F.G.S., etc., Chairman of Halifax School Board,* 38, *Elmfield Terrace, Halifax.*
1889 ... Chadwick, G. W., 23, *St. Hilda's Terrace, Whitby.*
— ... **Chadwick, Samuel,** *F.G.S., Mount Pleasant, Malton.*
— ... Chaloner, *Rev.* John William, *Vicarage, Newton Kyme, Tadcaster.*
1891 L. Champney, *Col.* John E., *J.P., The Woodlands, Halifax.*
1887 ... Chapman, Abel, *M.B.O.U., Silksworth Hall, Sunderland.*
1890 L. Charlesworth, John B., *J.P., Hatfield Hall, Wakefield.*
1886 ... Chaytor, R. C., *M.C.S., Scrafton Lodge, Middleham, viâ Bedale.*
— L. **Cheesman, William Norwood,** *The Crescent, Selby.*
— ... **Clark, James Edmund,** *B.A., B.Sc.,* 20, *Bootham, York.*
— ... **Clarke, Wm. Eagle,** *F.L.S., M.B.O.U., Nat. Hist. Dept., Edinburgh Museum of Science and Art*; 2, *Braidview Terrace, Morningside, Edinburgh.*
1886 ... Clarkson, W. C., *L.R.C.P., etc., Darley, Ripley, viâ Leeds.*
1884 ... Clayton, John, *Boxtree House, Thornton Road, Bradford.*
— ... **Clayton West Naturalists' Society.**
1887 ... **Cleveland Naturalists' Field Club.**
— ... Colby, George, *Surgeon, Malton.*
— ... **Cole, Rev. E. Maule,** *M.A., F.G.S., Vicarage, Wetwang-on-the-Wolds, viâ York.*
1884 ... Colley, Francis H., *Sharrow, Sheffield.*
1891 ... Collins, Francis Richard, *Kirkburton Vicarage, Huddersfield.*
— ... **Conacher, John, jun.,** 31, *Spring Wood Street, Huddersfield.*
1891 L. Cooke, James S., *J.P., F.R.A.S., Liversedge, viâ Normanton.*
1890 ... Cooper, William, *A.M.Inst.C.E., M.I.M.E., M.I.N.A.,* 18, *Linnæus Street, Hull.*
1886 ... Copley, Walter, *Clough Terrace, Sowerby Bridge.*
1890 ... Corbett, Herbert H., *M.R.C.S.,* 19, *Hall Gate, Doncaster.*
— ... **Cordeaux, John,** *M.B.O.U., Eaton Hall, Retford, Notts.*
1884 ... Cover, John Lee, *Sherburn, viâ South Milford.*
1887 ... **Craven Naturalists' Association,** *Skipton.*
1887 ... Crawshaw, C. B., *Bank Terrace, Dewsbury.*
1889 ... Crawshaw, *Rev.* Charles, *Linden House, Shipley.*
1889 ... Crosland, G. W. Kilner, *Holmfield, Fitzwilliam Terrace, Huddersfield*
1887 ... **Crossland, Charles,** 4, *Coleridge Street, Halifax.*
1884 ... Crossley, William Henry, *Maltby, near Rotherham.*
1884 ... Crossley, Miss Frances Ann, *Maltby, near Rotherham.*
1884 ... Crossley, Miss Mary A. B., *Maltby, near Rotherham.*
1889 ... Dacre, Hubert, 5, *Park Grove, York.*

1884 ... Dale, R. Thornton, 27, *Parish Ghyll Road, Ilkley.*
1885 H.L. **Dallinger,** *Rev.* **W. H.,** *LL.D., F.R.S., F.L.S., Pres. R.M.S., etc., Ingleside, Newstead Road, Lee, London, S.E.* (*Ex-President*).
1883 ... Darbishire, R. D., *B.A., F.S.A., F.G.S., Victoria Park, Manchester.*
1889 ... Davis, J. Percy Avison, *Chevinedge, Halifax.*
— ... **Davis James William,** *F.S.A., F.L.S., F.G.S., Chevinedge, Halifax* (*Mayor of Halifax*).
— ... Davison, George, *Garden House, Keldgate, Beverley.*
1889 ... Davison, Richard, *Driffield.*
1888 ... Dawson, Oswald, *M.C.S., Caledonian House, Leeds.*
1883 ... Dawson, Percival W., 101, *Westbourne Avenue, Hull.*
1891 ... Dawson, R. F., 5, *Noble Street, Great Horton Road, Bradford.*
— ... **Dennis, George C.,** 11, *Tower Street, York.*
1885 ... **Denny, Alfred,** *F.L.S., Professor of Biology in the Firth College*; 1, *Broomgrove Crescent, Sheffield.*
— ... Devonshire, *His Grace the Duke of, K.G., F.R.S., Devonshire House, Piccadilly, London, W.*; *and Bolton Abbey, Skipton.*
— .. **Dewsbury Naturalists' Society.**
1884 ... **Dickinson, Francis Wm.,** 26, *Bridgegate, Rotherham.*
1890 ... Dickons, J. Norton, 12, *Oak Villas, Manningham, Bradford.*
— ... **Dobrée, N. F.,** *F.E.S., The New Walk, Beverley.*
1891 ... Doncaster, Edwin D., *Green Bank, Sheffield.*
— ... **Doncaster Microscopical and General Scientific Society.**
1889 H.L. **Dresser, Henry Eeles,** *F.L.S., F.Z.S., etc., Topclyffe Grange, Farnborough, R.S.O., Kent* (*Ex-President*).
1889 ... Drury, A., *M.B., C.M., Landon House, Ferguson Street, Halifax.*
1883 ... **Dunning, J. W.,** *M.A., F.L.S., F.E.S.,* 12, *Old Square, Lincoln's Inn, London, W.C.*
— ... **Eddy, J. Ray,** *F.G.S., F.R.M.S., The Grange, Carleton, Skipton.*
1891 ... Edmondson, Joseph, *Heath Avenue, Halifax.*
1889 ... Edson, George, *Bacon's Farm, The Marishes, Pickering.*
— ... **Elland Naturalists' Society.**
1885 ... Ellis, H. M., *Westbourne Villas, Beverley.*
1887 ... Emerson, E. B., *B.A., J.P., Tollesby Hall, Middlesbrough.*
— ... **Emmet, John,** *F.L.S., The Poplars, Boston Spa, R.S.O.*
1887 ... Emmet, Mrs., *The Poplars, Boston Spa, R.S.O.*
1884 ... Eskholme, George, *J.P., Beech-en-Hurst, Rotherham.*
1887 ... Farrah, John, *Crescent Road, Low Harrogate.*
— ... Faulding, Joseph, *Boxley House, Tenterden, Kent.*
1890 ... Fawcett, George, *Keld, Swaledale, viâ Richmond, Yorks.*
— ... Featherstone, I. Garbutt, *Brompton, viâ York.*
1887 ... Fisher, *Rev.* Robert, *M.A., Sewerby Vicarage, viâ Hull.*
1887 ... Fitzgerald, Francis R., *M.C.S.*, 32, *Granville Square, London, W.C.*
1888 ... Fitzwilliam, *Hon.* W. H. Wentworth, *M.P., The Lodge, Malton.*
1889 ... Fletcher, Charles H., 1, *Pavilion Square, Scarborough.*
1889 ... Fletcher, William, *Post Office, Pickering.*
— ... **Foggitt, William,** *South Villa, Thirsk.*
1890 L. Foljambe, Cecil G. Savile, *J.P., Cockglode, Ollerton, Newark.*
1887 ... **Fortune, Riley,** *F.Z.S., Ravensgill, Franklin Mount, Harrogate.*
— ... Foster, Charles, 5, *King's Place, Headingley, Leeds.*
1890 ... Foster, *Rev.* F. Barham, *B.A., Heckmondwike.*
1890 ... Foster, John Machell, *Burgate House, Pickering.*
— ... Foster, Matthew, *Houghton Hall, Sancton, Brough.*
1889 ... Fountain, Joshua, *Ship Inn, Filey.*
— ... **Fowler,** *Rev.* **William,** *M.A., Vicarage, Liversedge, viâ Normanton* (*Ex-President*).
1884 ... Fox, *Rev.* Henry E., *M.A., M.B.O.U., St. Nicholas' Vicarage,* 12, *South Bailey, Durham.*
1890 ... Frank, George, *Low Hall, Kirby Moorside, viâ York.*
1883 H.L. **Gallwey,** *Sir* **Ralph Payne,** *Bart, M.B.O.U., Thirkleby Park, Thirsk* (*Ex-President*).
— ... Gardiner, H. T., *Times Office, Goole.*
1885 ... Gardner, John, *F.E.S.*, 8, *Friar Terrace, Hartlepool.*
1883 ... **Gaunt, Leonard,** *Prospect House, Farsley, Leeds.*

1886 ... Gaunt, Mrs. L., *Prospect House, Farsley, Leeds.*
1887 ... **Gerrard, John,** *Government Inspector of Mines, Wakefield.*
1888 ... Gibb, George S., *LL.B., Chestnut Grove, Heworth, York.*
1891 ... Gledhill, Edward, 15, *New Bond Street, Halifax.*
— ... **Goole Scientific Society.**
1883 ... Gough, *Rev.* T., *B.Sc., F.G.S., King Edward VI. School, East Retford.*
1891 ... Grahl, C. E., *The Limes, Headingley, Leeds.*
— ... **Green, A. H.,** *M.A., F.R.S., F.G.S., etc., Professor of Geology in the University of Oxford,* 137, *Woodstock Road, Oxford* (*President*).
— ... **Gregson, William,** *Baldersby, Thirsk.*
1887 ... **Grimshaw, Percy H.,** 8, *Elm Grove, Burley-in-Wharfedale.*
1888 ... Grimston, Francis Augustus, *Mozergh House, Kendal.*
1884 ... Grove, Edmund, *F.R.M.S., Norlington, Preston, Brighton.*
1887 ... Haigh, G. H. Caton, *Aber-iâ, Penrhyndeudraeth, Merionethshire*; *and Grainsby Hall, Great Grimsby, Lincolnshire.*
— ... **Halifax Scientific Society and Geological Field Club.**
1889 ... **Hall, A. E.,** *F.E.S., Norbury, Pitsmoor, Sheffield.*
1890 ... Hallimond, Henry T., 3, *Lune Street, Saltburn-by-the-Sea.*
1889 ... Hancock, *Rev.* W. E., *M.A., Vicarage, Knaresborough.*
1887 ... Handley, John, *Briggflatts, Sedbergh, R.S.O.*
1887 ... **Hardcastle, C. D.,** 31, *Victoria Place, Leeds.*
1891 ... Harding, George, F., 4, *Back Crib Lane, Halifax.*
— ... **Harker, Alfred,** *M.A., F.G.S., Woodwardian Museum, and St. John's College, Cambridge*; *and* 3, *Park Avenue, Princess Avenue, Hull.*
— ... Harrison, John, *Tillage Works, Goole.*
1891 ... Harrison, Joseph H., *Porter Street, Staveley, Chesterfield, Derbyshire.*
1886 ... **Harrogate and District Naturalists' Society.**
1888 ... **Harrogate Ellesmere School Natural History Society.**
1885 ... Harvie-Brown, John A., *F.R.S.E., F.Z.S., M.B.O.U., etc., Dunipace House, Larbert, N.B.*
1890 ... Hawell, *Rev.* John, *M.A., Vicarage, Ingleby Greenhow, Middlesbrough.*
1891 ... Hawkesworth, Edwin, 60, *Bruce Street, New Wortley, Leeds.*
— ... **Heckmondwike Naturalists' Society.**
— ... Herries, *The Right Hon.* M. F. Constable-Maxwell, *Lord, Lord-Lieutenant of the East Riding, Everingham Park, York.*
1891 ... Heslington, T. C., *Ripon.*
— ... **Hewetson, H. Bendelack,** *M.R.C.S., F.L.S., F.Z.S.,* 10, *Hanover Square, Leeds.*
— ... Hewett, William, 6, *Howard Street, Fulford Road, York.*
— ... **Hey,** *Rev.* **Wm. C.,** *M.A., M.C.S., St. Olave's Vicarage, York.*
1883 ... **Hick, Thomas,** *B.A., B.Sc., Owens College*; *Brighton Grove, Rusholme, Manchester.*
— ... Hindley, A. D., *Liversedge, viâ Normanton.*
1890 L. Hirst, Ben., *J.P., Tamewater, Dobcross, near Oldham.*
— ... Hirst, Joseph, *Sunset Terrace, Birkby, Huddersfield.*
— ... **Hobkirk, Charles C. P.,** *F.L.S., West Riding Union Bank, Dewsbury* (*President-Elect*).
1890 ... Hodgson, Thomas, *Burgate, Pickering.*
— ... Hodgson, William, *Wheelgate, Malton.*
1889 ... Hodsman, George, 8, *Feversham Terrace, York.*
— L. **Holgate, Benj.,** *F.G.S., Regent House, Grosvenor Road, Headingley, Leeds.*
1891 ... Holmes, H. S., *B.Sc., Training College, Carmarthen.*
1891 ... Holtby, Alfred Charles, *Heaton House, Boroughbridge, York.*
1889 ... Holtby, John, *Buck Hotel, Driffield.*
1883 ... Hopkinson, John, *F.L.S., F.G.S., F.R.M.S., etc., The Grange, St. Albans. Herts.*
1884 ... **Horne, William,** *F.G.S., Market Place, Leyburn, viâ Bedale.*
1889 ... **Howarth, Elijah,** *F.R.A.S., Curator of Sheffield Public Museum, Weston Park*; 169, *Northumberland Road, Sheffield.*
1891 ... Howarth, James Henry, *Yorkshire Bank, Skipton.*
1885 ... Huddart, *Rev.* G. A. W., *M.A., LL.D., Kirklington Rectory, Bedale.*
1889 ... **Huddersfield Naturalists' Society.**
1884 ... **Hudleston, Wilfred H.,** *M.A., F.R.S., F.L.S., F.G.S., F.C.S., etc.,* 8, *Stanhope Gardens, London, S.W.* (*Ex-President*).

— ... **Hull Field Naturalists' and Scientific Society.**
1888 ... **Hull Geological Society.**
1888 ... **Hull Scientific Club.**
1883 ... Hurst, Joseph S., *J.P., Copt Hewick Hall, Ripon.*
1891 ... Hutchinson, Charles H., *Victoria Avenue, Barnsley.*
1891 ... Hutchinson, W. B., *F.R.A.S., A.I.E.E., The Observatory, Liversedge, viâ Normanton.*
1891 ... Ianson, G. G., *Northgate, Wakefield.*
1884 ... **I'Anson, Joseph Coventry,** *F.S.A., F.G.S., etc.*, 6, *Britannia Terrace, Saltburn-by-the-Sea.*
— ... Ingleby, James, *Eavestone, near Ripon.*
— ... Ingram, Hobson, 57, *Louis Street, New Leeds, Leeds.*
1885 ... Irvin, *Rev.* Benjamin, *M.A., The Vicarage, Saltburn-by-the-Sea.*
1884 ... Irvine, Charles Stuart, *Lawnswood, Adel, Leeds.*
1890 ... Jackson, Andrew Marvel, *Victoria Chambers, Hull.*
— ... Jackson, George, 2, *Clement Street, York.*
— ... **Jackson, John,** *M.P.S., High Street, Wetherby.*
— ... **Jessop,** *Rev.* **William,** *F.A.S., Woodcliffe, Rawdon, Leeds.*
1889 ... Johnson, Henry, 2, *Queen Street, Barnsley.*
1890 ... Jones, A. Orlando, *M.D., Cardigan Villa, Harrogate.*
1890 ... Jones, George Fowler, *Quarrybank, Malton.*
1889 ... Jones, John E., *Balmoral Place, Halifax.*
1890 L. Jones, R. Heywood, *J.P., Badsworth Hall, Pontefract.*
— ... Jowitt, Mrs. Hannah, *Thornton Grove, Ripley, Leeds.*
1891 ... Jubb, Tom, 26, *Milton Place, Halifax.*
1883 ... Kendall, Richard Wm., 57, *Manchester Road, Denton, Manchester.*
1888 ... **Kidston, Robert,** *F.R.S.E., F.G.S.*, 24, *Victoria Place, Stirling, N.B.*
1889 ... King, John, *Grove Villa, Franklin Road, Harrogate.*
1884 ... **Kirk, J. M.,** *F.R.M.S.*, 1, *Bass Terrace, Doncaster.*
1890 L. Kitson, *Sir* James, *Bart., J.P., Gledhow Hall, Leeds.*
— L. **Knubley,** *Rev.* **E. Ponsonby,** *M.A., M.B.O.U., Staveley Rectory, viâ Leeds.*
— ... Ladmore, E. J., *Grosvenor Place*, 149, *Manningham Lane, Bradford.*
1889 ... Lambert, Abraham, 7, *York Terrace, Harrogate.*
1884 ... Lancaster, Wm. J., *Church Street, Barnsley.*
1890 ... Last, Edwin Walter, *Mount Edgerton, Huddersfield.*
1888 ... **Law, Robert,** *F.G.S.*, 11, *Cromwell Terrace, Halifax.*
1891 ... Laycock, Thomas, jun., *Deepdene, Franklin Road, Harrogate.*
1888 ... Leach, R. E., *M.A., F.G.S.*, 23, *Regent Street, Hartlepool.*
1883 ... **Leadman, A. D. H.,** *F.S.A., Boroughbridge, viâ York.*
— ... **Lee, Phineas Fox,** *West Park Villas, Dewsbury.*
— ... **Leeds Conchological Society.**
— ... **Leeds Geological Association.**
— ... **Leeds Naturalists' Club.**
1890 L. Lees, Edward B., *J.P., Thurland Castle, Kirkby Lonsdale.*
1890 ... LeTall, Benjamin Bower, *M.A.Lond.*, 20, *Bootham, York.*
1887 ... **Leyburn Literary and Scientific Society.**
1886 ... Lightfoot, *Rev.* Geo. H., *M.A., The Vicarage, Pickering.*
1890 L. Lilford, *Right Hon. Lord, F.L.S., etc., Lilford Hall, Oundle, Northamptonshire.*
— ... Lister, Thomas, 45, *Norfolk Street, King's Lynn, Norfolk.*
— ... **Liversedge Naturalists' Society.**
1889 ... Lofthouse, J. H., 17, *Holmedale Terrace, Harrogate.*
1889 ... Longster, Thomas Piper, *Mowbray Terrace, Malton.*
— ... Loten, Philip W., *Easington, viâ Hull.*
1889 ... Lucy, Charles T., *York Union Bank, Pickering.*
— ... Lund, Charles, *Ilkley.*
1891 ... Lund, Joseph, 6, *Beulah Arcade, Harrogate.*
1884 ... **Lund, Percy,** 6, *Park Drive, Heaton, Bradford.*
— ... Lupton, Henry, *F.E.S., Lyndhurst, North Grange Road, Headingley.*
— ... McGhie, Wm. K., *Castle Hill, Rastrick, Brighouse.*
1887 ... Mackie, *Rev.* John H., *M.A., Sedbergh School, Sedbergh, R.S.O.*
— ... **McLandsborough, John,** *F.G.S., F.R.A.S., F.R.Met.S., etc.*, 5, *Lindum Terrace, Manningham, Bradford.*

1891 ... McLean, Kenneth, *Studley Terrace, Harrogate.*
1888 ... Macpherson, Angus, 16, *Teresa Terrace, Coatham, Redcar.*
1891 ... Maddock, *Rev.* Henry E., *M.A., F.G.S., Patrington Rectory, Hull.*
— ... Malt, James, *Folkestone, Kent.*
— ... **Malton Field Naturalists' and Scientific Society.**
1891 ... Mansbridge, William, *Luther Place, Horsforth, Leeds.*
1891 ... Marriott, Arthur S., *Manor Lawn, Dewsbury.*
1884 ... Marsh, Robert, jun., *Rotherham.*
— ... Marshall, John, *F.G.S., Summer Place,* 27, *Broughton Lane, Manchester.*
1890 L. Marshall, Arthur, *Hallsteads, Penrith.*
1890 ... Marshall, J. J., *Market Weighton, R.S.O.*
1889 ... Mason, James Eardley, *S.S.C., The Sycamores, Alford, Lincolnshire.*
— ... Mason, Philip Brooke, *J.P., F.L.S., F.E.S., M.C.S., etc., Horninglow Street, Burton-on-Trent.*
— ... **Massee, George E.,** *F.R.M.S.,* 41, *Gloucester Road, Kew, Surrey.*
— ... Meade, R. H., 1, *Mount Royd, Manningham, Bradford.*
1887 ... Meek, J. M., 2, *Nelson Terrace, Coatham, Redcar.*
1884 ... Metcalfe, John Henry, *Leyburn, viâ Bedale.*
— ... **Miall, Louis C.,** *F.L.S., F.G.S., Professor of Biology in the Yorkshire College*; 5, *Montpellier Terrace, Cliff Road, Leeds.*
1891 ... Middleton, Charles, 14, *Lord Street, Halifax.*
1891 ... Miln, Thomas Erskine, *Greenbank Road, Darlington.*
1884 ... Mitchell, T. Carter, *Topcliffe, near Thirsk.*
1889 ... Mitchelson, Thomas, *The Mount, Pickering.*
— ... **Moiser, Henry R.,** *F.G.S., Heworth Grange, York.*
1887 ... More, Alexander Goodman, *F.R.S.E., F.L.S., M.R.I.A.,* 74, *Leinster Road, Dublin.*
1883 ... Morrison, Walter, *M.P., Malham Tarn House, Bell Busk, viâ Leeds.*
1889 ... Mortimer, J. R., *Corn Merchant, Driffield.*
1890 ... Nassau, W. T. H., 7, *Balmoral Terrace, Anlaby Road, Hull.*
1886 ... Naughton, John, *Ellesmere School, Park View, Harrogate.*
1889 ... Naylor, E., 48, *Market Street, Bradford.*
1887 ... **Nelson, Thomas H.,** *M.B.O.U., Oxley Villa, Coatham, Redcar.*
— ... **Nelson, William,** *M.C.S., Gandy Row, Crossgates, Leeds.*
1885 ... **Newbitt, Thomas,** 17, *Royal Crescent, West Cliff, Whitby.*
1891 ... Newhouse, W. H., 8, *Church Street, Brighouse.*
1890 L. Newton, *Rev. Canon* Horace, *The Vicarage, Driffield.*
1890 ... Nicholls, A. E., *Assoc.M.Inst.C.E.,* 43, *Reginald Terrace, Leeds.*
1890 ... Nicholson, John, *Chapeltown, Pudsey.*
1891 ... Niven, George, *Northgate House, Cleckheaton.*
1891 ... Norman, *Rev.* Wm. Haswell, *M.A.,* 18, *New North Road, Huddersfield.*
— ... Nuttall, William, *Moorside, Eccleshill, Bradford.*
1883 ... Oldfield, George Wm., *M.A., F.E.S.,* 21, *Longridge Road, Earl's Court, London, S.W.*
1888 ... Oldroyd, Charles, *Luddington, Goole.*
1886 ... Oliver, Jesse, *The General Infirmary, Leeds.*
— ... Ormerod, Thomas, 72, *Norroy Road, Putney, London, S.W.*
— ... **Ovenden Naturalists' Society.**
1890 L. Oxley, Henry, *Spenfield, Weetwood, Leeds.*
1888 ... Oxley, *Rev.* W. H., *M.A., Petersham Vicarage, Surrey.*
1888 ... Painter, *Rev.* W. Hunt, *Knypersley Hall, Congleton, Cheshire.*
— ... Pape, Tom, *Helmsley, viâ York.*
— ... **Parkin, George,** *York Street, Wakefield.*
— H.L. **Parsons, Henry Franklin,** *M.D., F.G.S.,* 4, *Park Hill Rise, Croydon, Surrey.*
1883 ... Paterson, A., 25, *Milton Street, Doncaster.*
1883 ... Paver-Crow, Richard, *J.P., Ornhams Hall, Boroughbridge, York.*
1891 L. Pawson, Albert Henry, *Lawns House, Farnley, Leeds.*
1891 ... Pawson, Mrs. Alice Sarah, *Lawns House, Farnley, Leeds.*
— ... Payne, Henry, *M.D., Newhill Hill, West Melton, viâ Rotherham.*
1884 ... Peach, Robert, *North Park Road, Harrogate.*
— ... Pearson, Hugh W., *Castle Howard Road, Malton.*
— ... Pease, H. J. Robinson, *J.P., St. Mary's House, Hengate, Beverley.*
— ... Pease, W., *Elm Cottage, Hook, near Howden.*

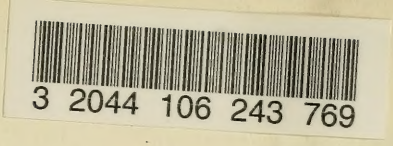
1888 ... Peirse, *Sir* Henry Beresford, *Bart., J.P., Bedale Hall, Bedale.*
1889 ... Perkins, Frank, 22, *James Street, Harrogate.*
1890 ... Phillips, John H., 22, *Albemarle Crescent, Scarborough.*
1889 ... Pickard, Isaac, *North Park Road, Harrogate.*
1889 ... Place, James A., *Chemist, Pickering.*
1885 ... **Platnauer, H. M.,** *A.R.S.M., B.Sc., F.G.S., etc., Curator of the York Museum; Low Royd, St. Olave's Road, York.*
— ... Pocklington, C., *F.R.M.S.*, 14, *Bertram Terrace, Manningham, Bradford.*
— ... Pocklington, Henry, *F.R.M.S.*, 41, *Virginia Road, Leeds.*
1889 ... **Pocklington Literary and Philosophical Society.**
— ... Pollard, Harry, 19, *Britannia Terrace, New Wortley, Leeds.*
— L. **Porritt, Geo. T.,** *F.L.S., F.E.S., Greenfield House, Huddersfield.*
— ... Powell, Francis Sharp, *M.P., Horton Old Hall, Bradford.*
1887 ... **Powys,** *Rev.* **H. Annesley,** *M.A., Meanwood Vicarage, Leeds.*
1883 ... Priestman, Frederick, *J.P., Pierremont, Manningham, Bradford.*
1890 ... Procter, John William, *Ashcroft, York.*
1884 ... Prodham, Herbert, *Allerston, near Pickering.*
— ... Proudlock, John, *The Nurseries, Market Weighton, R.S.O.*
1889 ... **Purlwell Wesleyan Field Club, Batley.**
1887 ... Pyman, Walter H. S., *Moss Brow, Whitby.*
1885 ... Radcliffe, *Sir* J. Percival, *Bart., F.R.A.S., Rudding Park, Knaresborough.*
1890 ... Raine, Joseph, *Newbiggin, Richmond, Yorkshire.*
1890 ... **Ravensthorpe Naturalists' Society.**
— ... Rawson, F. G. S., *Thorpe, near Halifax.*
1891 ... Reith, A. W., *M.A., Heath Grammar School, Halifax.*
1887 ... Reynolds, Richard, *F.I.C., F.C.S., Cliff Lodge, Hyde Park, Leeds.*
1890 ... Rhodes, James, 9, *Henry Street, Keighley.*
— ... **Richardson, Hugh,** *B.A., M.C.S., Sedbergh School, Sedbergh, R.S.O.*
1883 ... Richmond, *Right Rev.* J. J. Pulleine, *D.D., Bishop of, Stanhope Rectory, viâ Darlington.*
— ... **Ridgway,, J. Ambrose,** *F.R.A.S., The Foundation School, Beverley.*
— ... Ripon, *The Most Hon.* George Frederick Samuel Robinson, *Marquis of, K.G., F.R.S., etc., Studley Royal, Ripon.*
— ... **Ripon Naturalists' Club and Scientific Association.**
— ... **Roberts, George,** *Lofthouse, near Wakefield.*
1890 ... Roberts, Walter, *St. Sepulchre Gate, Doncaster.*
1887 ... Robinson, William, *Green Bank, Sedbergh, R.S.O.*
— ... **Roebuck, Wm. Denison,** *F.L.S., M.C.S., Sunny Bank, Leeds.*
1891 ... Rosenstock, Rudolph, *B.A.Oxon.*, 92, *Fitzwilliam Street, Huddersfield*; *and* 7, *Clarendon Place, Brighton.*
— ... **Ross, Lewis Buttle,** *F.C.S., etc., Driffield.*
1883 ... **Rotherham Naturalists' Society.**
1884 ... Roundell, Chas. Savile, *Dorfold Hall, Nantwich, Cheshire.*
1889 ... Rowley, Brooke, 52, *Moorfield Terrace, Savile Park, Halifax.*
— ... Rowley, Walter, *M.Inst.C.E., F.G.S., etc., Alder Hill, Meanwood, Leeds.*
1889 ... Rowntree, Allen, 5, *Beulah Terrace, Scarborough.*
— ... **Rowntree, James Henry,** *Westwood, Scarborough.*
1888 ... St. Paul, *Major* Horace, *J.P., The Willows, Ripon.*
1890 ... St. Quintin, W. H., *J.P., Scampston Hall, Rillington, York.*
1884 ... **Sawdon, Fred. John,** *M.D.*, 32, *Beverley Road, Hull.*
— ... Saynor, Benj., 4, *Kellam Street, Accommodation Road, Leeds.*
1890 ... **Scarborough Field Naturalists' Society.**
1887 ... **Scarborough Philosophical and Archæological Society.**
— ... Scargill, A., *East Parade, Sheffield.*
1889 ... Scharff, R. F., *B.Sc., Ph.D., M.C.S., Curator, Nat. Hist. Museum, Dublin.*
1890 ... Scott, Frederick A., *Sutton, near Hull.*
1888 ... Scrope, Simon Thomas, *J.P., D.L., Danby Hall, Bedale.*
1891 ... Seed, Albert, 8, *Crown Street, Halifax.*
— ... **Sheffield Naturalists' Club.**
— ... Shepherd, C. W., *Brook Street, Ilkley.*
1889 ... Sherwood, Eleazer, *M.D., F.R.Bot.S.Ed., Prospect Hill, Whitby.*
1891 ... Shillito, John, 17, *Cavendish Terrace, Halifax.*
— ... Shuffrey, *Rev.* W. A., *M.A., Halton Gill Vicarage, Arncliffe, viâ Skipton.*
1888 ... Silabon, George, *Waterhouse Lane, Hull.*

— ... Sims, Henry, 13, *All Hallowgate, Ripon.*
— ... **Slater,** *Rev.* **Henry H.,** *M.A., F.Z.S., M.B.O.U., Irchester Vicarage, Wellingborough, Northamptonshire.*
— ... **Slater, Matthew B.,** *F.L.S.*, 1, *West Grove Villas, Newbiggin, Malton.*
1888 ... Smith, Christopher W., *Harome, Nawton, viâ York.*
1883 ... Smith, *Rev.* Hy., *M.A., Middleton-One-Row*; *and Clarendon House, Redcar.*
1884 ... Somerset, Herbert, *Regent Square, Doncaster.*
— ... **Soppitt, Henry Thomas,** 3, *Rose Mount, Bolton, Bradford.*
— ... **Sorby, Henry Clifton,** *LL.D., F.R.S., F.L.S., F.G.S., F.R.M.S., etc., Broomfield, Sheffield* (*Ex-President*).
1890 ... Sparks, William, *Nafferton Road, Driffield.*
1885 ... **Speight, Harry,** *Gaythorne View, West Bowling, Bradford.*
— ... **Spencer, James,** 8, *Salisbury Place, Akroydon, Halifax.*
1890 ... Spencer, Thomas, *The Terrace, Richmond, Yorkshire.*
1890 ... Spiers, *Miss* Ada Maria, 221, *Rockingham Street, Sheffield.*
1890 ... Spiers, *Rev.* William, *M.A., F.R.M.S., F.G.S., Beverley Road, Hull.*
1891 ... Stather, John W., 16, *Louis Street, Hull.*
— ... **Stead, John James,** *Albert Cottage, Heckmondwike.*
1886 ... **Stears, John,** 125, *Coltman Street, Hull.*
— ... Steel, R. Elliot, *M.A., Hawthorn House, Baildon, Shipley, Yorkshire.*
1889 ... Stevenson, John, *Whitby.*
1889 ... Stewart, John T., 3, *Belle Vue Terrace, Whitby.*
1884 ... **Stiles, M. H.,** 2, *Frenchgate, Doncaster.*
1891 **L.** Stobart, William C., *J.P., Spellow Hill, viâ Leeds.*
— ... Stoks, Edwin, *New York, Rawdon, Leeds.*
1883 ... Stott, Walter Henry, *Southwell House, Hall Gate, Doncaster.*
1889 ... Strickland, Walter W., 3, *Rosemont Villas, Richmond, Surrey.*
1884 ... **Stuart, J. A. Erskine,** *L.R.C.S.Ed., etc., Heckmondwike.*
— ... **Stubbins, John,** *F.G.S., F.R.M.S.*, 38, *Ebberston Terrace, Victoria Road, Hyde Park, Leeds.*
1889 ... Suddaby, W. M., *Crown Hotel, Wheelgate, Malton.*
— ... **Summerfield,** *Rev.* **R. A.,** *B.A., North Stainley Vicarage, near Ripon.*
1890 ... Sutcliffe, J. Williams, 27, *West View, Hopwood Lane, Halifax.*
— ... Swailes, Johnson C., *Toll Gavel, Beverley.*
1887 ... **Tate, Thomas,** *F.G.S.*, 5, *Eldon Mount, Woodhouse Lane, Leeds.*
1889 ... Taylor, J. D., *Springfield, Halifax.*
— ... **Taylor, John W.,** *F.L.S., M.C.S., etc., Outwood Villa, Horsforth, Leeds.*
1884 ... Taylor, *Rev.* Richard Vickerman, *B.A., Melbecks Vicarage, viâ Richmond, Yorkshire.*
1889 ... Taylor, Thomas, *Paddock House, Whitby.*
— ... Taylor, Vincent, *B.A., Burnside School, Ilkley.*
— ... Taylor, W. W., *M.A.*, 10, *King Street, Oxford.*
— .. **Teasdale, Washington,** *F.R.A.S., F.R.M.S., Headingley, Leeds.*
— ... Terry, James, 29, *Holmes Street, Westgate, Bradford.*
— ... Tetley, Charles F., 47, *Cardigan Road, Headingley, Leeds.*
— ... Tew, Thos. Wm., *J.P., Carleton Grange, Pontefract.*
1891 ... Thackrah, Charles Herbert, 4, *Crown Street, Halifax.*
1886 ... Thirkettle, George, 18, *Claremont Road, Headingley, Leeds.*
1887 ... **Thirsk Natural History Society.**
1890 ... Thomas, W. H., 10, *West Terrace, North Ormesby, Middlesbrough.*
1884 ... Thompson, *Major* Ben. Blaydes, 11, *Franklin Parade, Harrogate.*
1891 ... Thompson, *Miss* Frances Phillips, *Castle Hill House, Settle.*
1890 ... Thompson, M. Lawson, *Diamond Street, Saltburn-by-the-Sea.*
1891 ... Thompson, *Miss* Rachel Ford, *Castle Hill House, Settle.*
1884 ... Thompson, Richard, *Dringcote, York.*
1886 ... Thompson, *Rev.* Wm., *M.A., J.P., Guldrey Lodge, Sedbergh, R.S.O.*
— ... **Thrippleton, John,** *Burley View, Burley, Leeds.*
— ... **Tindall, Edward,** *Knapton Hall, Rillington, York.*
— ... Tindall, George, *High Street, Newmarket, Suffolk.*
1891 ... Toothill, James Arnold, 21, *York Terrace, Akroydon, Halifax.*
1884 ... Travis, *Rev.* William Travis, *M.A., The Rectory, Ripley, viâ Leeds.*
1889 ... Trechmann, Chas. O., *Ph.D., F.G.S.*, 10, *Cliff Terrace, Hartlepool.*
1889 ... Turner, Benjamin, 10, *Pitt Street, Barnsley.*
1891 ... Vaughan, Mrs., *Jubilee Buildings, Doncaster.*

1890 ... Veitch, W. Y., *M.D., Grange Road, Middlesbrough.*
1890 ... Waddington, Robert, *Haslingden, Lancashire.*
1888 ... **Waite, Edgar R.,** *F.L.S., Curator of the Leeds Museum, Headingley, Leeds.*
— ... Waite, William, *Cliffe Cottage, Clayton West, viâ Huddersfield.*
— ... Wake, C. Staniland, *M.A.I., Welton, near Brough.*
1889 ... **Wakefield,** *The Right Rev.* **William Walshaw How,** *D.D., etc., Lord Bishop of, Overthorpe, Thornhill, Dewsbury.*
— ... **Wakefield Naturalists' and Philosophical Society.**
1888 ... Walker, A. W., *York and East Riding Bank, Malton.*
1884 ... Walker, *Councillor* Isaac, 11, *Lindum Terrace, Rotherham.*
1890 ... Walker, John Francis, *M.A., F.G.S., F.L.S., F.C.S., F.I.C., F.Z.S., etc.,* 45, *Bootham, York.*
1887 ... **Walker, Samuel,** 75, *Union Terrace, York.*
— ... **Walsingham,** *The Right Hon.* **Thomas De Grey,** *Lord, M.A., F.R.S., F.L.S., Pres. E.S., etc., Merton Hall, Thetford, Norfolk; and Blubberhouses, Yorkshire* (*Ex-President*).
1884 ... **Walton, F. Fielder,** *M.R.C.S., F.G.S.,* 10, *Charlotte Street, Hull.*
— ... Ward, George, *F.I.C., F.C.S.,* 1, *Buckingham Terrace, Hyde Park, Leeds.*
1884 ... Ward, Seth, *Fairfields, Dewsbury.*
1887 ... **Ward, Thomas F.,** *Park Road South, Middlesbrough.*
1891 ... Waterfall, Charles, *Holly Cottage, Welton, Brough.*
1885 ... **Watson, Arnold Thomas,** *Southwold, Tapton Crescent, Sheffield.*
1887 ... Watson, John William, *Redcar.*
1887 ... Watts, *Rev.* A., *F.G.S., F.R.G.S., The Rectory, Witton Gilbert, Durham.*
1890 ... Waud, Henry, *The Gardens, Brinkburn, Darlington.*
1888 ... Weetman, Henry, *F.Z.S., The Hawthorns, Little Haywood, Stafford.*
— ... **West, William,** *F.L.S.,* 15, *Little Horton Lane, Bradford.*
— ... Wharncliffe, *The Right Hon.* E. M. S. G. Montagu-Stuart-Wortley-Mackenzie, *Earl of, Wortley Hall, near Sheffield.*
1889 ... Wheldon, John Wm., *Burgate, Pickering.*
1890 ... Whitaker, J. A., *Craven Lodge, Halifax.*
1885 ... Whitaker, Joseph, *F.Z.S., M.B.O.U., Rainworth Lodge, Mansfield, Nottinghamshire.*
— ... Whitaker, T. Stephen, *F.R.G.S., Everthorpe, Brough.*
1889 ... Whiteley, Frederick, *Clare Road, Halifax.*
1891 ... Whitley, J. H., *B.A., Greenroyd, Halifax.*
— ... **Whitwell, William,** *M.C.S., Roslin,* 4, *Thurleigh Road, Balham, London, S.W.*
— H.L. **Williamson, William Crawford,** *LL.D., F.R.S., Professor of Biology in the Owens College; Fallowfield, Manchester* (*Ex-President*).
1890 ... Wilson, H. J., *M.P., Osgathorpe Hills, Sheffield.*
— ... **Wilson, J. E.,** 8, *Summerseat Place, Bradford.*
1887 ... Wilson, J. Mitchell, *M.D.,* 51, *Hall Gate, Doncaster.*
— ... **Winter, George,** 13, *Baxtergate, Doncaster.*
— ... Wood, John, *B.A., F.R.A.S., Wharfedale College, Boston Spa, R.S.O.*
1889 ... Wood, Richard, *M.D., Beverley Street, Driffield.*
1888 ... **Woodall,** *Major* **John W.,** *M.A., J.P., F.G.S., etc., St. Nicholas House,* Scarborough.
1883 ... Woodd, Basil Thomas, *J.P., D.L., Conyngham Hall, Knaresborough.*
1890 ... Woodd, C. Hampden B., *B.A., Roslyn, Hampstead, London, N.*
— ... Woodd, Charles H. L., *J.P., F.G.S., Oughtershaw Hall, Buckden, viâ Skipton.*
1891 ... Woodhead, David, *Highfield Terrace, Halifax.*
1890 ... Woodhead, T. W., *Birkby, Huddersfield.*
1891 ... Worsnop, C. H., *Cheapside, Halifax.*
1890 ... Worswick, Richard Arthur, *Surveyor, Saltburn-by-the-Sea.*
1890 L. Wright, C. B. E., *J.P., Bolton Hall, Clitheroe.*
— ... Wright, John, *Terrington, viâ York.*
— ... Yewdall, Edwin, 58, *Wade Lane, Leeds.*
1889 ... **Yeadon Geological Society.**
— ... **York Field Naturalists' and Scientific Society.**

The Secretaries of the Union will be glad to be informed of any changes of address or corrections in the above List.

BOUND MAY 1970


3 2044 106 243 769

Date Due